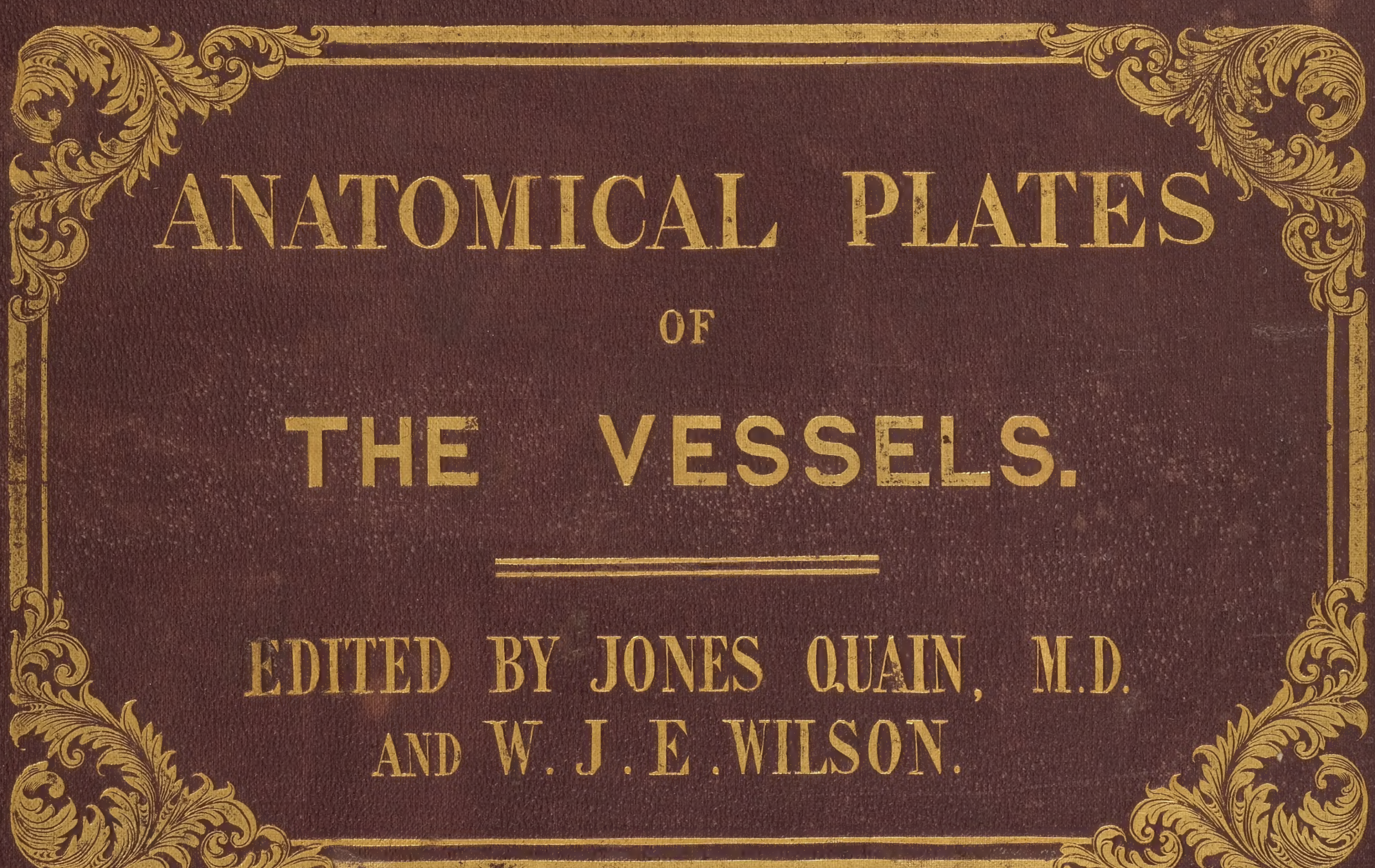




ANATOMICAL PLATES

OF

THE VESSELS.

EDITED BY JONES QUAIN, M.D.
AND W. J. E. WILSON.

F. 314

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Thomas, John, James, Brown

St Thomas's Hospital

October 1st 1848

QUAIN and WILSON
[Anatomical plates. Div. II.]

Wm. J. Brown
St. Thomas's Hospital

John Henry

John S. M. Evans,

L F P. L. S.

Landesley

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May 27th 1877.

F. 314

THE
VESSELS
OF
THE HUMAN BODY;
IN
A SERIES OF PLATES,
WITH REFERENCES AND PHYSIOLOGICAL COMMENTS.

EDITED BY JONES QUAIN, M.D.

AND

WILLIAM J. E. WILSON.

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THE
VESSELS
OF
THE HUMAN BODY;

A SERIES OF PLATES.

WITH REFERENCES AND EXPLANATORY COMMENTS.



EDITED BY JAMES CLARK M.D.

WILLIAM A. HENRY

LONDON:
PRINTED BY SAMUEL BENTLEY,
Dorset-street, Fleet-street.

ADVERTISEMENT.

THIS Publication consists of a Series of Anatomical Drawings, some original, others selected from monograph treatises or from systematic works. The highest place in the former class is deservedly conceded to the works of Scarpa and Tiedemann, and in the latter, to those of Mascagni and Caldani; but from their size and the style in which they are executed, the expense of publication is necessarily such as to confine their usefulness to comparatively few persons. It may, however, be fairly admitted, that the collections of Cloquet and Loder, though not of equal pretension, are no less valuable to students, as a guide to the knowledge of that complex fabric whose composition they seek to investigate; and to those of maturer age, as a means of reviving impressions received during their earlier studies. As, however, even the works last named, from their price, are inaccessible to some, and to others from the descriptions and references being given in a foreign language, the want of a similar publication in an English garb has been for some time complained of.

To supply the want here noticed, and at a moderate price, is the object of the present undertaking. The Plates are accompanied by letter-press, containing detailed references to the various objects delineated, the names being set down in English, Latin, and French. But with a view to render them intelligible to a greater number of persons, a running comment on each Plate is given, stating in general terms, and divested (as far as can be) of all technicality, the uses and purposes which the different objects serve in the animal economy. The drawings are taken on stone by Mr. W. Fairland from drawings by Mr. J. Walsh, and Mr. W. Bagg, and the printing executed by Hullmandel, Graff and Soret and Fairland.

The Work consists of FIVE DIVISIONS, as follows:

FIRST.—The Muscles.

SECOND.—The Heart and Blood Vessels (Arteries and Veins), with the Lymphatic and Lacteal Vessels.

THIRD.—The Brain and Spinal Marrow; the Nerves and Organs of Sense.

FOURTH.—The Organs of Digestion, Respiration, and Secretion.

FIFTH.—The Bones and Ligaments.

As the order in which the Divisions may appear is of secondary consequence, those are taken first which are most wanted by Students, and which are most interesting in themselves. The number of Plates will be about two hundred and fifty.

Plate 1.



J. Walsh del.

Printed by Gray & Sons.

William Fairland lith.

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VASCULAR SYSTEM.

CHAPTER I.

THE human body is made up of solid and fluid constituents, which bear to one another not only the more obvious relation of containing and contained parts, but also exert a mutual influence under the ever varying conditions of health and disease. The proportion of the fluids to the solids is considerable; it may be estimated as nine to one: so that the mere circumstance of their quantity would demand for them an especial attention from the anatomist and physiologist; whilst the changes which their characters and properties undergo form a most important subject for the investigation of the pathologist.

The fluids, or, as they are frequently called, the humours, though very numerous, and differing much in composition, properties, and uses in the economy, may yet be arranged under three heads:—

PLATE I.

This plate gives a view of the commencement of the great artery (aorta) as it issues from the heart, together with the leading branches, which carry the blood to the head and upper extremities; and the trunk of the great vein (vena cava vel magna), which returns the blood from the same parts. In order to bring these different objects into view, the sternum and the fore part of the ribs have been removed, together with part of the clavicle at each side; the pericardium, or heart-purse, is opened, and the front of it removed, so as to expose the heart itself.

Nos. 1, 2, 3, 4, 5. The upper ribs cut through. 6, 6. The clavicles. 7, 7. The great pectoral muscle at each side cut through, in order to expose the ribs previously to applying the saw to them. 8, 8. The reflected or folded part of the great pectoral muscle at each side. 9, 9. The small pectoral muscle. 10, 10, 10. The great serratus muscle at each side. 11, 11. At each side, the lungs. 12, 12, 12, 12. At each side, the investing membrane of the lungs, viz. the pleura, cut through. 13, 13, 13, 13. The pericardium cut through. 14, 14, 14. The right ventricle of the heart. 15. The pulmonary artery arising from the right ventricle. 16. The part of the left ventricle of the heart which is seen in this mode of viewing it. 17. The great artery, viz. the aorta, issuing from the left ventricle. 18. The transverse part of the curve or arch of the aorta. 19. The arterial trunk which carries blood to the right side of the neck and head, as well as to the right upper limb, and which from this circumstance is called the brachio-cephalic artery (arteria brachio-cephalica: arteria innominata). 20. The left carotid artery (arteria carotis sinistra). 21. The left subclavian artery (a. subclavia sinistra). 22. Part of the right auricle of the heart. 23. The great vein (vena cava superior) terminating in it: this part of the vessel will be observed to be within the pericardium. 24. The great vein outside the pericardium. 25. The left brachio-cephalic vein (v. brachio-cephalica sinistra: v. innominata sinistra), so named because it returns the blood from the left upper limb, and from the left side of the head. 26. The right brachio-cephalic vein (vena brachio-cephalica dextra: v. innominata dextra). 27. The right carotid artery, and, 28. the right subclavian artery, issuing from a common trunk (the brachio-cephalic, No. 19). 29. At each side, the subclavian artery, arching outwards to reach the anterior scalenus muscle. 30. At each side, the subclavian artery, where it turns down under the clavicle. 31. At each side, the anterior scalenus muscle. 32. At each side, the thyroid artery or axis, so called from its usually giving off several branches. 33. Its ascending branch going up to the thyroid gland (ramus thyroideus). 34. The supra-scapular branch (ramus supra-scapularis, vel transversalis humeri). 35. The posterior scapular branch (r. scapularis posterior, vel transversalis colli). 36. The ascending cervical branch (r. cervicalis ascendens). 37. At each side, the internal mammary artery (arteria mammaria interna). 38. The fore part of the windpipe (trachea). 39, 39. The lateral lobes of the thyroid gland. 40. The transverse or connecting piece of the gland, called its isthmus. 41. The fore part of the thyroid cartilage of the larynx. 42. At each side, part of the sterno-hyoid muscle. 43. Part of the sterno-thyroid muscle at each side. 44. Part of the sterno-cleido-mastoid muscle at each side. 45. Part of the omo-hyoid muscle at each side.

ARTERIES.

B

First. The blood, or central mass, which constantly flows, as it were, in a circle, being alternately received into the heart, and propelled from it into all parts of the body.

Secondly. The various fluids which are separated from the blood by the different secreting organs: of these, some are intended to serve special purposes in the economy, for instance, the saliva, the mucous and gastric fluids; whilst others are eliminated from it, viz. the urine, perspiration, &c.

Thirdly. The fluids brought into the central mass from without:—these are the product of digestion and absorption; they are called chyle, and lymph, and are intended to supply the losses sustained by the processes of nutrition and secretion.

So long as life lasts, these solid as well as fluid constituents are subjected to a constant internal motion and change; some of the particles of which they consist, and which had lain a longer or shorter time within the system, being separated and cast out, whilst others are admitted to replace them. The form of the body remains the same, though its component parts are thus subjected to a perpetual mutation; but it will be at once perceived that these changes are molecular, having reference to the mere particles of which the textures and organs of our living fabric are made up. However minute and slow these changes may be, they present many important considerations to those who are engaged in examining the processes of nutrition and growth, as well as the various structural changes which occur in the intimate texture of organs.

It is now, and has been for a long time, almost universally known, that the blood, the proper nutrient fluid in the higher animals, moves, or rather is made to move, from point to point through a certain prescribed course, commencing from a given spot, and after a while returning to the same again, after having gone the round of its circuit. This could not occur with the requisite degree of precision and regularity, unless it were contained within tubes, and that the tubes were so fashioned as to allow the current to pass in one direction, and one only, at the same time that they were furnished with some provision to prevent its reflux. The ancients, from being unacquainted with these conditions, supposed the blood to move forwards and backwards in one set of vessels, having a sort of flux and reflux. The tubes here spoken of are the blood-vessels of the body; they branch out into every part of it. On referring to the diagram or plan of the vessels in Plate III. fig. 1, it will be seen that one set of these is coloured red, and that it commences by a large trunk at the heart. From this, as from a common conduit, offsets proceed to the head, to the arms, to the lower limbs, and to the various parts of the body. These offsets gradually diminish in size, but increase in number, until, finally, in the interior of our different organs and textures, they become as fine as hairs, and are thence termed capillary. The blood contained in this order of vessels is of a bright red colour, and possesses those properties which fit it for supplying materials for their growth and nutrition to the parts to which it is conveyed, as well as furnishing to secreting organs the materials of the secretions which they elaborate. A new order of tubes commences where those hitherto noticed may be said to terminate; they are coloured blue, and contain the blood, which is now changed in its characters and properties, after having parted with some of its constituents. The current within these vessels flows in the opposite direction from that in the preceding set; all the tributary streams which run into them being made to set towards the heart, to which they are in due time conveyed. Now, as the blood is thus made to issue from a particular spot—the heart, and to return again to the same, as if it flowed in a circle, (though the outline of its course in no one of its many gyrations approaches the form of an exact circle, ellipsis, or any other mathematical figure,) it is said to *circulate*, and the whole process is termed *circulation*.

The blood-vessels are divisible into two sets, which are termed arteries and veins. The former convey from the heart the pure blood, which is fitted for the purposes of the economy; the latter convey back to it that which is in a manner effete and exhausted. Now, the blood, brought back by the veins to the heart, is conveyed onwards from it, by the pulmonary artery, to the lungs, where it is exposed to the influence of the atmosphere, having previously received, through a most important inlet, the chyle, or nutritious substance extracted from the food by the process of digestion. This mixed fluid, viz. the venous blood and the chyle, having been duly aerated in the lungs, is returned to the heart again, to be propelled through the great arterial trunk into the system at large. Two streams may thus be said to begin and to terminate at the heart: one flowing from it to the lungs by the pulmonary artery, and returning by the pulmonary veins; the other extending through the whole body, and returning by two great veins which bring back the blood, the one from the upper part of the body, the other from the lower. The former has been termed, from its shorter course, the *lesser* circle, and, from its destination, the *pulmonary* circle; the latter is, with equal propriety, called the greater or aortic circle, and not unfrequently the *systemic*, from its connexion with the system at large. Though some of the older anatomists had conceived sufficiently correct notions of the course of the

blood in some parts of the system, yet none of them were able to combine these together, so as to form a connected whole ; that was reserved for Harvey, who, about the year 1619, first described the true course of the blood in the different orders of vessels, and demonstrated the correctness of his opinions by a complete series of proofs and experiments.

That the blood flows from the heart in the arteries, and that it returns again by the veins, may be proved by experiment, by observation, and by a consideration of certain contrivances called valves,—their structure, and the purposes which they serve in the economy,—in other words, their final causes. Harvey drew the proofs of his general propositions from each of these sources, and so combined them as to form a train of reasoning irresistibly cogent to any reflecting person. One of the experimental proofs consists in tying a thread tightly upon an artery as it runs along one of the limbs in an animal selected for the purpose. It will be found that the thread or ligature acts like a stop-cock upon the current within the vessel ; it literally shuts it off, so that the vessel becomes empty beyond the point at which it is applied, but is rendered turgid in the interval intercepted between the heart and the point indicated : the mode of applying the ligature is shown in Plate III. fig. 1, where it will be seen coiled round the artery at the right side.

If the vessel be punctured above the ligature, the blood will issue from the orifice in a stream and with force ; but if the puncture be made below the ligature, none will issue from it. Again, if, instead of tying it in this way, the vessel be cut across, the blood will be projected in a jet from the part next the heart, and little, if any, will flow from the other segment or cut end of the vessel. These facts show that the blood flows from the heart in the arteries. In the next place, let the ligature be placed upon a vein ; the vessel will be observed to swell as if distended in the part beyond the obstruction, and to collapse as if emptied in the part intercepted between this and the heart, or at all events up to the point at which some tributary stream is poured into it. As many veins of considerable size run immediately under the skin, particularly in the limbs of persons engaged in laborious employment, and as the coats of these vessels are thin and compressible, the experiment may be made by merely pressing upon one of them : it will at once be found to shrink in the part next the heart, and to swell beyond the finger ; showing from which side the current comes, and whither it goes. These experiments and observations sufficiently demonstrate the direction of the current in the arteries and veins which form the greater circle : the proof is rendered complete when the arrangement and effects of the valves placed in the interior of the veins and at the commencement of the great arterial trunks are taken into account. The valves are folds or doublings of the lining membrane which project into the veins, where they represent so many small floodgates, for they are so adjusted as to allow the blood to flow freely towards the heart, whilst they effectually prevent its reflux. Again, at the commencement of the great artery (the aorta or systemic trunk), a valvular apparatus is also placed, which gives free transit to the blood as it is propelled from the heart into the vessel, but which as effectually resists its return, even when pressed by the recoil of the artery distended by the blood thrown into it. The form and arrangement of the valves in the veins are given in Plate III. fig. 2, and in the heart in fig. 4.

The course of the blood in the greater circuit being established, it remains for us to trace its current through the pulmonary circle, and to mark the place and mode of communication between the two circulations. Harvey distinctly noted the fact, that the heart's cavities alternately received blood into them and propelled it out of them. On opening the chest of a small animal,—for instance, a frog,—he saw the heart swell and enlarge when distended by the blood brought into it by the veins, and then diminish again when it emptied itself by expelling the contained fluid. Observations conducted in this way could merely determine the fact of the entrance and exit of the blood ; they could not establish the line of its direction through the heart's cavities. This point can be cleared up satisfactorily only by examining the position and mechanism of the valves. In Plate III. fig. 4, the right auricle and ventricle are shown, and certain membraneous folds are seen in the cavity of the latter, connected with its sides by small cords, which act like so many checks in preventing the folds from being pressed backwards into the auricle. A moment's consideration will show that these folds, which are the valves so often spoken of, are so constructed as to allow the blood to pass freely from the auricle into the ventricle, and at the same time effectually resist its return, acting on the principle of a floodgate. Again, where the ventricle opens into the artery (pulmonary) which issues from its upper part and reaches to the lungs, there also three folds or valves are placed, which give free transit to the current projected from the ventricle into the artery, but resist its return. From this it will at once appear that the blood which is brought back to the heart by the two great veins (the upper one, fig. 4, No. 1, returning the venous blood from the head, neck, and upper limbs ; and the

lower one, No. 2, from the lower limbs and the inferior part of the body,) is received into a cavity, No. 3, which is the right auricle: when distended, this cavity, or rather its walls, being muscular and contractile, reacts upon the fluid so brought into it, and squeezes it through an oval aperture which leads into the ventricle, No. 4; and then the ventricle, which is much more muscular, instantly contracts when filled, and would inevitably force a considerable part of the fluid back into the auricle, but that the valvular folds, No. 5, are pressed down so as to form a complete impediment to any movement in this direction. There remains, however, a ready outlet, and there the blood escapes, viz. by the opening which leads into the pulmonary artery. Into this vessel the blood is projected with a force proportioned to the contractile power of the ventricle; and having once passed the valves, No. 6, its return is cut off. Hence it must proceed onwards to the minute branchings of the artery in the lungs: these terminal branches of the artery (see Plate III. fig. 5, No. 1.) turn upon themselves, coiling round the air-vesicles, and open into the incipient radicles of the veins, No. 2, which receive the blood as it is being aerated, and bring it back to the left side of the heart; thus completing the smaller circle, or, as it is termed, the pulmonary circulation. Now, when the blood is thus conducted to the heart, it is received into the left auricle, from which it is pressed into the left ventricle. At the opening of communication between these cavities, there is another valvular apparatus which prevents the reflux of the blood, so that the fluid is forced upwards into the great artery (aorta), the orifice of which is also guarded by three valves similar to those at the commencement of the pulmonary artery. Hence, when the stream enters the artery, and its return is effectually prevented, it must proceed on its way, and go the round of the greater or systemic circulation.

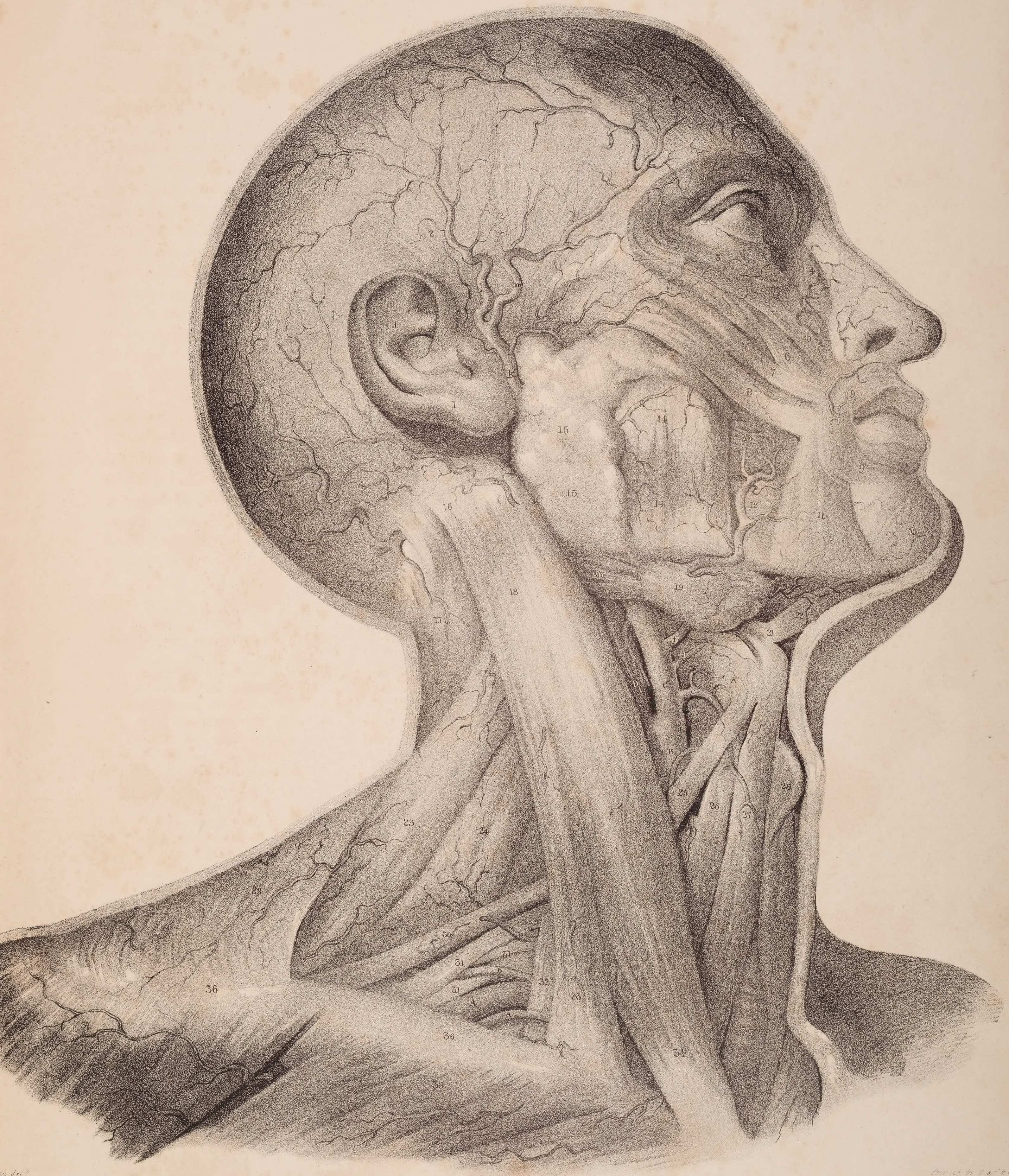
The division of the circulation into the greater and the lesser, or the pulmonary and systemic, as established by Harvey, continued to be universally received, until Bichât (not by any means with a view to question its correctness or truth) adopted another, on physiological grounds. The blood in the branches and trunks of the great veins (*venæ cavæ*), in the right side of the heart and pulmonary artery, being of a reddish-brown colour (*venous*), whilst that in the pulmonary veins, in the left side of the heart, and likewise in the aorta and its ramifications, is red (*arterial*), suggested to the mind of this great physiologist a corresponding division of the circulation into that of the *red* and that of the *dark* blood.

PLATE II.

In this side-view of the face and neck, the principal arteries, together with the various muscles to which they have relation, are shown.

- No. 1, 1. The ear. 2, 2. The temporal fascia, which binds down the muscle of the same name, and supports the artery (temporal). 3, 3. The upper and lower segments of the orbicular muscle of the eye-lids. 4. The elevator muscle of the lip and nose. 5. The elevator muscle of the upper lip. 6. The elevator muscle of the angle of the mouth. 7. The smaller zygomatic muscle. 8. The larger zygomatic muscle. 9, 9. The upper and lower segments of the orbicular muscle of the lips. 10. The depressor muscle of the lower lip. 11. The depressor muscle of the angle of the mouth. 12. Part of the lower jaw-bone seen in the interval between the muscles. 13. The buccal, or buccinator muscle. 14, 14. The masseter muscle. 15, 15. The parotid gland. 16. The mastoid process of the temporal bone, where it gives insertion to the sterno-cleido-mastoid muscle. 17. The upper part of the splenius capitis muscle. 18. The upper part of the sterno-cleido-mastoid muscle. 19. The submaxillary gland. 20. The posterior part of the digastric muscle;—21. Its tendon, where it is attached to the side of the tongue-bone (*os hyoides*). 22. The anterior part of the digastric muscle. 23. The levator anguli scapulæ muscle. 24. The posterior scalenus muscle. 25. The upper part of the omo-hyoid muscle. 26. The sterno-thyroid muscle. 27. The sterno-hyoid muscle. 28. The prominent part of the thyroid cartilage of the larynx. 29. Part of the trapezius muscle. 30. The lower part of the omo-hyoid muscle. 31, 31, 31. The divisions of the brachial plexus of nerves. 32. Part of the anterior scalenus muscle. 33. The clavicular part of the sterno-cleido-mastoid muscle. 34. The sternal part of the same muscle. 35. The trachea. 36, 36. The clavicle. 37. Part of the deltoid muscle. 38. Part of the great pectoral muscle.
- A. The subclavian artery inclining downwards to get behind the clavicle.
- a. The supra-scapular branch (*ramus supra-scapularis: r. transversalis humeri*). b. The posterior scapular branch (*r. posterior scapulæ, vel transversalis colli*). c. The superficial cervical branch.
- B. The trunk of the common carotid artery.
- C. The external carotid artery.
- D. The internal carotid artery.
- e. The superior thyroid branch of the external carotid artery. d. The lingual branch. f, f, f. The facial artery. g. The transverse artery of the face. h. The posterior auricular branch. i. The occipital artery where it becomes superficial after having passed from under cover of the cervical muscles. k. The temporal artery ascending to the side of the head, having passed above the parotid gland, which covers the lower part of it. l. Its anterior branch. m. The posterior branch. n. The frontal branch of the ophthalmic artery as it emerges from the orbit.

Plate 2.



Wm Fairland del.

London, John Taylor, Upper Gower Street

Fig. 1.

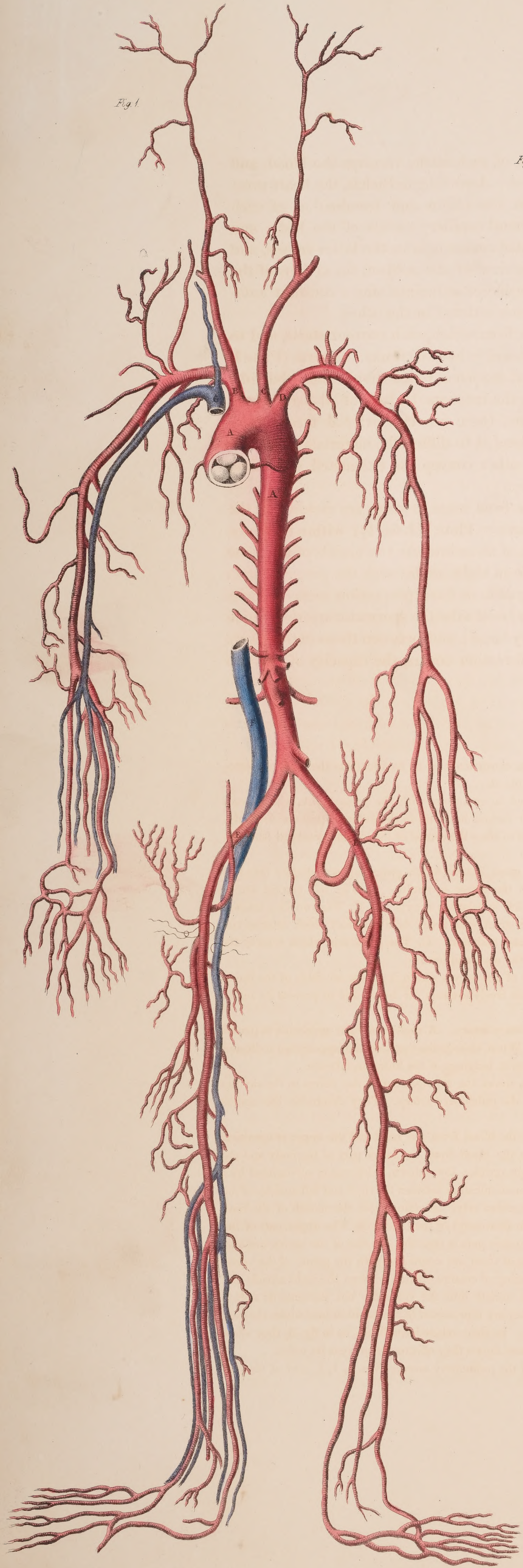


Fig. 2.

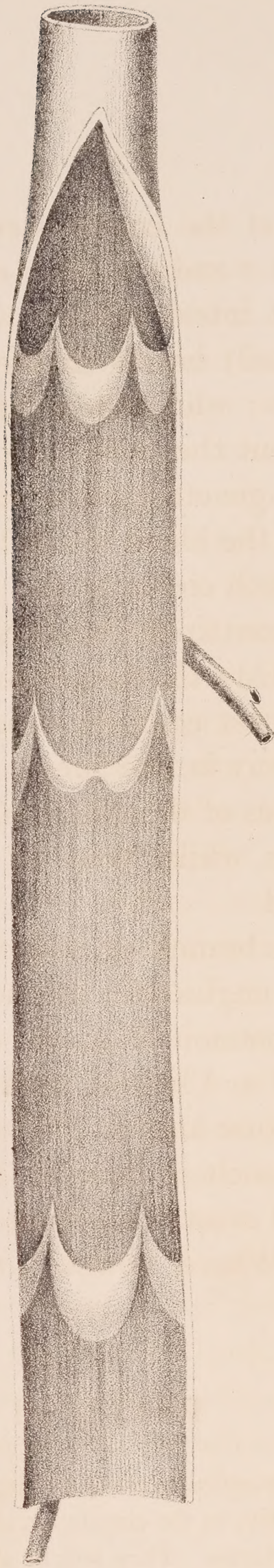


Fig. 3.

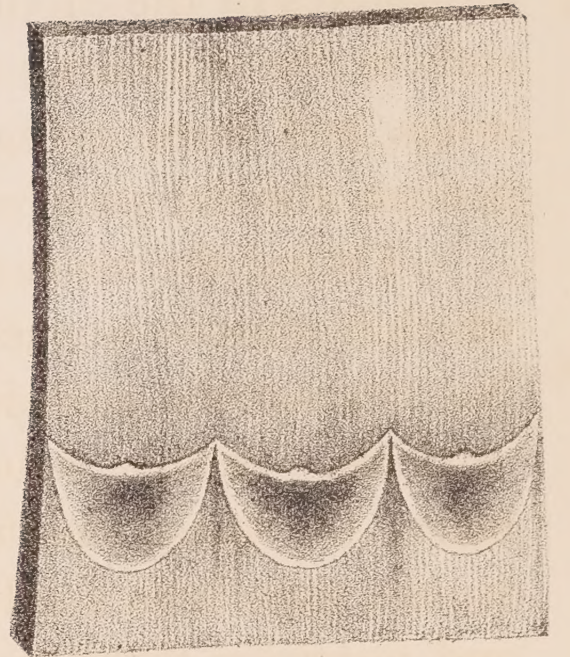
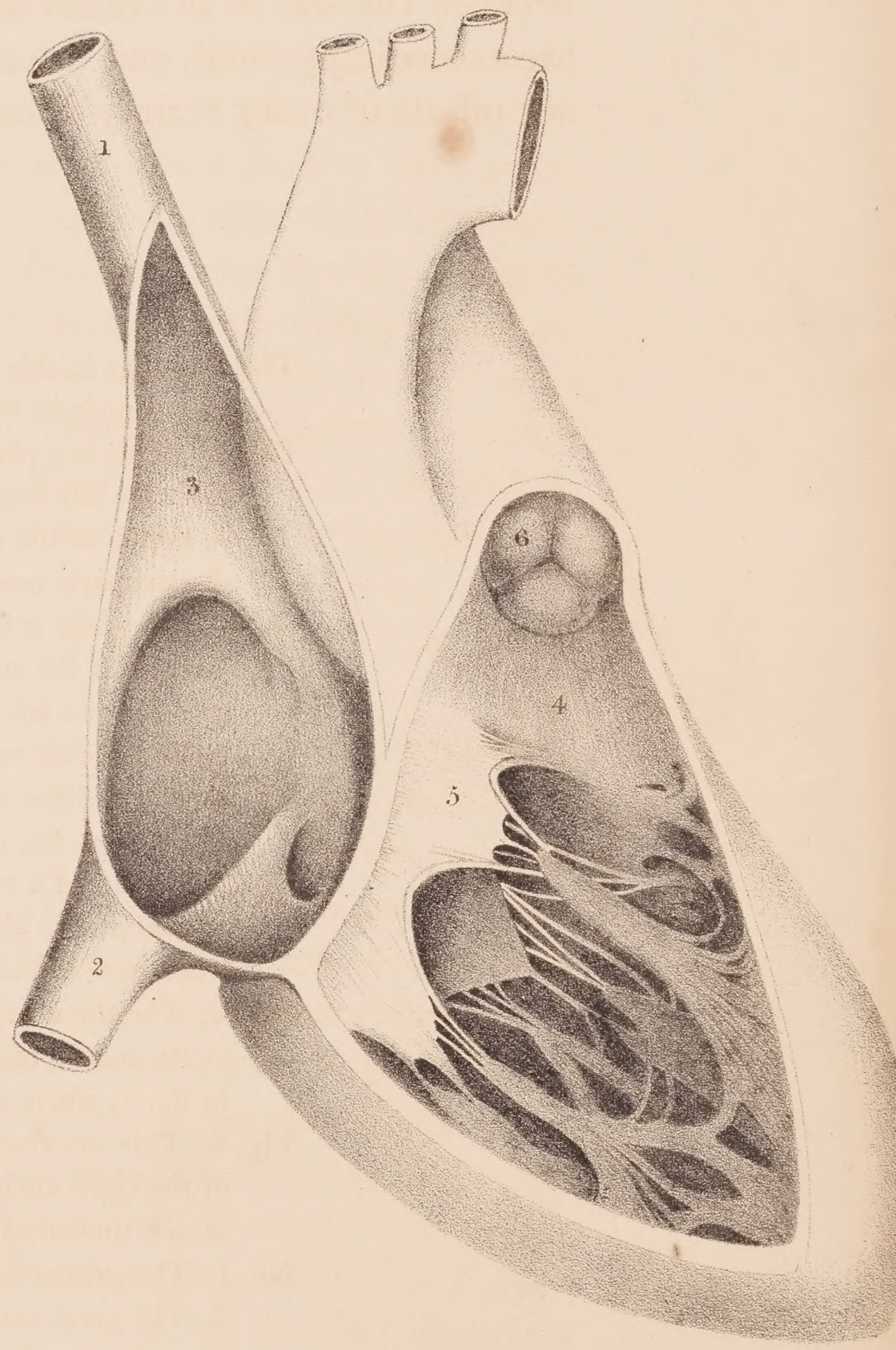
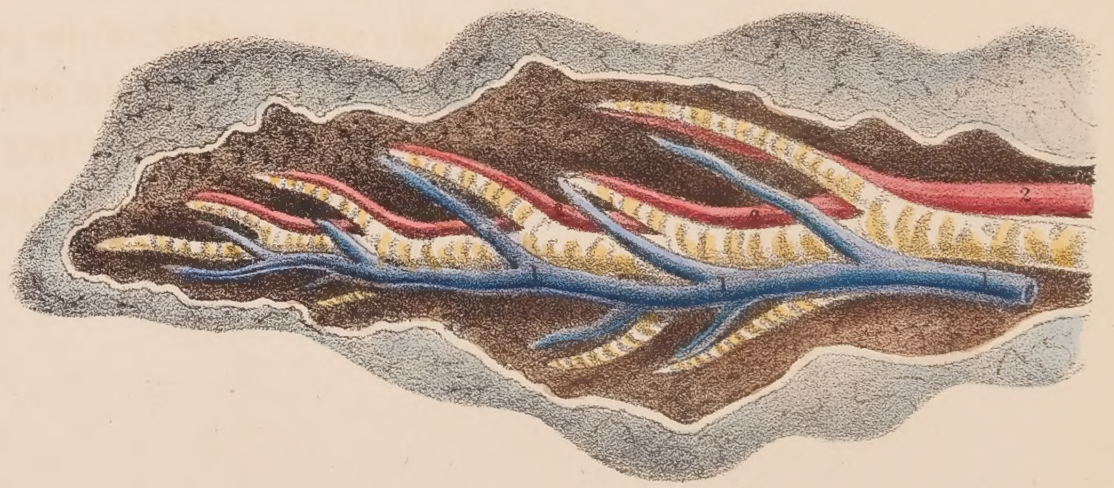


Fig. 4.



B. Clarke del.

Fig. 5.



According to Harvey, the heart, placed at the commencement of each circle, receives the blood, and propels it forwards, to describe the greater and the lesser course. According to Bichât, the heart must be conceived to be situated at a point intermediate between the origin and termination of each system; of which one (the dark-blooded) begins in the general capillary vessels of the body, and terminates in the capillaries of the lungs; whilst the red-blooded commences in the latter vessels, and ends in the capillaries diffused throughout the body. In this view of the subject, the actions of the lungs, and those going on in the body generally, may be considered as maintaining a constant antagonism, the one purifying and restoring the blood which becomes vitiated in the other.

Taking the heart as the centre of each circle, or the point from which each current starts, and to which it returns, we see the tubes which contain the blood commencing by two trunks, the aorta (Plate I. No. 17) and the pulmonary artery (No. 15): the former gives off branches, which divide and subdivide, until they become reduced to the minutest capillary tubes in the intimate texture of all parts of the body; the latter ramifies in the same way in the lungs. Thus there are two arterial trees, whose trunks arise from the heart; the branches of the one being intended to diffuse the materials of growth and nutrition through the body at large, whilst those of the other convey the exhausted and effete blood to the lungs, to be there renovated.

The modes in which arterial trunks branch off, and divide from stage to stage, are various: in the limbs, the branches generally form acute angles with the main artery (Plate III. fig. 1); within the body, we observe the aorta bifurcate into the common iliacs, and each of these into the two vessels of the same name (internal and external); the renal and lumbar arteries form right angles with the parent vessel; but the superior intercostals issue at obtuse angles. No assignable or fixed proportion seems to exist between the size of the vessel and its branches; from the aorta itself arise the spermatic arteries, which are exceedingly small, and the renal and carotid, which are very large; and between these extremes we see offsets of every variety of calibre. Where, however, a bifurcation occurs, the capacity of the two

PLATE III.

The drawings in this plate are intended to serve as diagrams, constructed so as to illustrate the different statements made in the text relative to the circulation of the blood.

Fig. 1. This is a plan of the arteries. They will be observed to commence with the great trunk, which issues from the left ventricle of the heart, and to reach by their various branches to the different parts of the body. A sketch of the veins is given at the right side, sufficient to show the course of the current returned from the distant parts toward the heart.

A, A. The great arterial trunk called the aorta. B. The great branch which passes up and divides into two vessels for the supply of the right side of the head and the upper extremity. C. The left carotid artery going to the left side of the neck and head. D. The left subclavian artery. E, E. The two iliac arteries passing down towards the lower extremities. F. The great vein (vena cava inferior) which returns the blood from the lower extremities, and from the pelvis and abdomen. G. The great vein which returns the blood from the upper extremities, and the right side of the neck and head.

Fig. 2. A view of a vein laid open to show the arrangement of the valves within it; these are folds of the lining membrane, so arranged as to allow all the blood to pass freely towards the heart, and to prevent its reflux when once it has passed beyond them.

Fig. 3. The three valves at the commencement of the pulmonary artery. A similar valvular apparatus is placed at the mouth of the aorta; both are crescent-shaped. When closed, they present the appearance indicated in fig. 1, where they are seen in the aorta, like three convex bulgings of the lining membrane.

Fig. 4. This drawing, taken from a preparation of the heart, shows the arrangement of the valves in the cavities of the right auricle and ventricle, and at the orifice of the pulmonary artery. They determine the course which the current of the blood must take.

No. 1. The great vein (descending vena cava) which returns the blood from the head and the upper extremities. 2. The great vein (ascending vena cava) which returns the blood from the lower part of the body and the lower limbs. 3. The upper part of the cavity of the right auricle; lower down, a depression surrounded by a concave margin indicates the position of the aperture of communication between the right and left auricles of the heart during the foetal state. The position of the Eustachian valve ascending from the mouth of the vena cava is indicated, and near it the orifice of the great vein (coronary) of the heart. 4. The upper part of the right ventricle where it joins with the pulmonary artery: this part is smooth; the rest of the cavity contains a number of fleshy bundles (columnæ carneæ), and some of them are connected with the points of the valve. 5. The three-pointed valve (tricuspid) placed at the opening of communication between the right auricle and ventricle. It allows the blood to pass freely from the auricle into the ventricle, but prevents its reflux. 6. The valves at the orifice of the pulmonary artery: they are represented in the position into which they are thrown when shut down by the distention of the artery. In their relaxed condition, as in fig. 3, they allow the blood to pass up into the artery; but in the state here shown they effectually prevent its reflux.

Fig. 5. A sketch of an air-tube, accompanied by a branch of the pulmonary artery, Nos. 1, 1, 1, and of the pulmonary vein, 2, 2, 2.

branches is always greater than of the vessel from which they proceed ; so that the stream of blood, in proportion as it is subdivided, becomes also more diffused, as it flows from a narrower into a wider channel. This was made a subject of particular consideration by those physiologists who, soon after Harvey's time, sought to follow up his views of the mechanism of the circulation. Adopting the opinion which he had taught, that the heart was the sole agent in propelling the blood, it became interesting to ascertain the impediments and resistance which it had to overcome. With this view they examined—the angles formed by the branches at their points of origin,—the number of divisions and subdivisions which took place down to their termination in the veins,—the proportions subsisting between the calibre of the minor currents, as compared with those from which they proceed,—and, finally, the friction of the blood against the sides of the vessels was taken into account. But the calculations led to no satisfactory result ; not perhaps because the problem to be solved was too complex, but that its conditions were too variable and uncertain.

The modes of communication between vessels are various ; sometimes two of them, from points more or less distant, converge and meet, forming an arch by their junction, from which issue small ramusculi to the surrounding parts : we observe this along the intestinal canal, and about some of the joints. Very commonly arterial branches are connected only at their ultimate terminations ; and under ordinary circumstances neither can be said to receive blood from the other, both being merely a means of supply to the parts to which they run ; but if the direct flow in one be cut off, then it will become filled from the other, the current being in the opposite direction to what it was originally, viz. from the branches into the trunk. Another mode of junction is by a short canal extended between two parallel arteries, as in the case of the anterior cerebral arteries ; or two of equal size join at an acute angle, and give rise to a third, as do the vertebals to form the basilar artery. These different communications are called anastomoses (*αναστομωω*, to communicate ; *ανα, στωμα*, a mouth) or inosculations, which, literally, mean the same thing ; yet in their technical application a difference is maintained between them ; the latter being used where the union is free and open, the vessels themselves joining, so that it becomes difficult to say at what point their opposing currents meet, as is exemplified in the colic, epiploic, and coronary arteries ; the former is generally employed when speaking of cases in which the minute branches communicate. When organs receive the materials of their growth and nutrition from two or more sources, the supply is less liable to disturbance or interruption than it otherwise would be ; and should an obstruction happen to occur, or be placed designedly upon the current from one quarter, the deficiency will be made up by the others. It is by these means that the circulation is adequately carried on in a limb after the main artery has been tied ; in such cases the blood is directed into a new or devious route, finding its way through the anastomoses existing between smaller vessels, and so what is termed “a collateral circulation” is established.

The veins, like arteries, present a ramified appearance ; but as the blood flows in them from their extreme branches (which are continuous with those of the arteries) towards the main trunk (*vena cava*), which opens into the heart, and as the diameter of that vessel is considerably less than the sum of the diameters of the veins which pour their contents into it, the motion of the current within them increases from stage to stage of its progress, because it is made to run from a wider into a narrower channel. The venous system, then, considered as a whole, seems to have been constructed on a hydraulic principle, which materially influences the passage of the blood it contains. It presents, on a general view, a series of cylindrical tubes, commencing in the interior of the different organs of the body, as well as in their remote or peripheral extremities. These, in the first instance, are so minute as to elude vision ; but they gradually increase in size and diminish in number, forming successively vessels larger and larger, until finally all terminate in a large trunk. Though the calibre of any given vessel in the series is larger than that of either of the branches which open into it, yet its diameter is less than the sum of their diameters taken together ; whence it follows, that the diameter of the common trunk is less than the sum of the diameters of the smaller vessels whose contents it receives. Now, when a current flows from a wider into a narrower bed (its level remaining unaltered), it necessarily becomes more rapid as it advances ; and, by an extension of the same principle, when a number of tributary streams open into a channel whose width is less than that of these currents taken together, a certain impetus is given by the mere fact of such an arrangement, which materially aids any other collateral means that may have been devised for expediting its progress.

Having reviewed the circulating apparatus thus generally, it becomes necessary to notice the peculiarities of each of the three sets of vessels which compose it ; as they exhibit not a few striking points of difference, more especially in structure and properties.

ARTERIES.

Artery, arterial tissue, arteria.—The term “artery,” in its original acceptation, meant a tube containing air, (*αἷς*, air; *τηρεῖν*, to contain,) or some subtile agent, whether called archæus or vital spirits. It was at one time supposed that veins alone carried blood, as they were observed at all times to contain it, in the dead as well as the living; but as arteries were always found empty after death, they were imagined to be the conductors during life of something more refined and ethereal. Though this hypothesis has been long forgotten, the term to which it gave rise is retained even now, notwithstanding that centuries have elapsed since a very different doctrine has been completely established. Arteries are usually deep-seated, their form tubular, and each, if viewed from its commencement to its termination, will be found not to taper gradually, but from stage to stage to present a series of cylinders, increasing in number as they decrease in size; for a portion included between any two branches, whether it be one inch or three in length, retains its diameter throughout.

The outer surface of each arterial tube is connected with the surrounding structures by cellular tissue, and by vessels and nerves: these are derived from some of the contiguous small branches, and are termed *vasa vasorum*, because they circulate in the coats of the vessels, at least in the two exterior, not being traced into the inner one. Nerves also ramify upon and within their structure to the same extent, being derived, whilst in the cavities, from the sympathetic system, and in the limbs from the cerebro-spinal system. In many parts, as in the neck and extremities, the cellular structure becomes condensed, and forms a cylindrical investment (called “a sheath”) for it; which, however, is not a part of its proper structure, as the connexion between them is very slight.

An artery is a cylindrical and highly elastic tube, composed of three coats or tunics, placed one within the other. The *external* coat is formed of cellular tissue, into which it may be reduced by maceration; its texture is closer where it is in contact with the middle coat, than externally, where it is somewhat loose and flocculent: it admits of considerable extension, and can retract when the distending cause is removed; and is so tough, as not to be divided by a hard ligature placed on the vessel, and so firm, as alone to resist the impulse of the current when the other coats are divided or torn.

The *internal* coat not only lines the arteries, but is continued into the ventricles of the heart; hence it is sometimes called the common membrane; and as it is smooth, and moistened by a fine halitus, which appears to be poured out upon its surface, it is by some considered analogous to serous membranes, and named accordingly. It is thin, homogeneous, and transparent, and so fragile as to be easily torn. Its inner surface is at all times in contact with the blood, the outer being in close union with the middle coat. At the ventricular openings it forms three folds, whose base, or line of attachment, which is convex, corresponds with the point of junction between the arteries and the ventricle; whilst their free and slightly concave border projects upward into the vessels, one surface looking towards its axis, the other resting against its side in the relaxed condition; but when distended with blood, they bulge or project downwards and forwards, so as to become convex when viewed from the ventricle, and concave from the artery. Each valvular fold thus disposed encloses a minute stratum of cellular tissue as its bond of union, and is bound down to the middle coat at the margin of one of the convex processes which it presents at its commencement: in the free margin of each is a small granule, called “corpus aurantii” or “sesamoideum.” Such are the *sigmoid* or *semilunar* valves, which prevent the reflux of the blood from the arteries back into the ventricles.

The *middle* coat (called also fibrous, muscular, elastic) is that upon which the most striking peculiarities of arteries depend. At its commencement it presents, in both vessels, (aorta and pulmonary artery,) not a straight border, but rather one which is scalloped by three notches into three processes, which pass down to the margin of the ventricle, but are not identified even by their tips with the fleshy fibres. It consists of pale, straw-coloured fibres, coiled obliquely round the circumference of the vessels, but none of them forming a complete circle. If an artery be stretched transversely, it will recoil and resume its original diameter; if elongated, it will retract. These are direct proofs of elasticity. When an artery no longer carries blood, as, for instance, when a ligature has been applied upon it, the part beyond the ligature will contract, its tubes will become obliterated, and finally, by an alteration in its mode of nutrition, will degenerate into a mere fibrous cord. This indicates a contractile power different from that resiliency which characterises structures simply elastic, and has been termed contractility of tissue, to denote that it is in some sort a vital property. The coats of arteries resist the effects of maceration for a considerable time, and yield on decoction but little gelatine, and no fibrine: hence the structure of their middle coat has been assimilated to that peculiar substance

called "tissu jaune"—"élastique," which forms the ligamenta subflava of the vertebræ, and the cervical ligaments in the lower animals. These physical and chemical properties constitute a marked line of distinction between the middle coat of arteries and muscle; but in some particulars, more especially in its vital properties, it manifests several points of resemblance to the muscular structure, so that it seems to constitute an intermediate link between it and the fibrous or fibro-cellular tissues.

That property of arteries which is here indicated, and which enables them to contract towards their centre, without having been previously distended, has been the subject of many controversies amongst physiologists. It has been variously denominated, by different persons,—tonicity, vital force, contractility, &c. The whole controversy may be reduced to this—are all the phenomena of extension and contraction that are presented by arteries attributable solely to their elasticity? Haller, Bichât, and Magendie, have taken the affirmative side of the question; Hunter, Sœmmering, Thomson, and Home, the opposite. A decided difference of opinion between such high authorities affords abundant evidence of the difficulty of the subject, particularly when we consider the great attention which they have severally paid to it, and the many experiments which they performed with a view to arrive at some satisfactory conclusion. Bichât's arguments against the irritability of arteries are as follow:—
1. Mechanical or chemical irritants applied to their external or internal surface, determine no contraction in them; nor, when divided longitudinally, do the edges of the incision become everted, as occurs in the intestines, or other irritable tubes. 2. When separated from the body, they manifest no signs of contractility: if the finger be introduced into a vessel, it is not compressed. Galvanism produces no contraction; and if any is caused by the application of an acid, it is attributable rather to its chemical action on their coats than to any vital power in them. "The arteries," says Magendie,* "nowhere present any indication of irritability; they remain immovable under the action of sharp instruments, of caustics, and of the galvanic current."

These results are not by any means conformable with those obtained by other physiologists. Dr. Thomson† "succeeded in producing complete contraction, by irritating, for some time, though gently, with the point of a needle, the small arteries in the web of a frog's foot." The same effect was also produced by weak volatile alkali; but when a saturated solution of common salt was

* Physiology, p. 415.

† Lectures on Inflammation, p. 85.

PLATE IV.

The direction, general relations, and the branches of the great arteries of the neck are here shown. The skin, the fascia, and the two superficial muscles, viz. the platysma and the sterno-mastoid, are removed in order to exhibit the arteries more clearly.

No. 1. The upper extremity or insertion of the sterno-mastoid muscle. 2. The lobe of the ear. 3. The masseter muscle. 4. The zygomaticus muscle. 5. Part of the parotid duct. 6. The buccinator muscle. 7. The depressor muscle of the angle of the mouth. 8. The splenius muscle. 9. The levator of the angle of the scapula. 10. The cornu of the os hyoides or tongue-bone. 11. The mylo-hyoid muscle. 12. The middle scalenus muscle. 13. The anterior scalenus muscle. 14. The upper part of the omo-hyoid muscle. 15. Part of the trapezius muscle. 16. The lower part of the levator of the angle of the scapula. 17. The third or posterior scalenus muscle. 18. The lower part of the omo-hyoid muscle. 19, 19, 19. Three of the divisions of the brachial plexus of nerves. 20. The lower part of the anterior scalenus muscle. 21. The trachea. 22. The outer end of the clavicle. 23. The clavicular part of the deltoid muscle. 24. The body of the clavicle. 25. The subclavius muscle. 26. The sternal origin of the sterno-mastoid muscle. 27. Part of the great pectoral muscle near its attachment to the humerus. 28. The short head of the biceps muscle. 29. The coraco-brachialis muscle. 30. The small pectoral muscle. 31. The intercostal muscles. 32. Part of the biceps muscle. 33. Part of the long head of the triceps muscle. 34. Part of the latissimus dorsi muscle. 35. The greater teres muscle. 36. The subscapular muscle. 37, 37. Part of the great serratus muscle. 38, 38. Sternal origin of the pectoral muscle.

A, A. The trunk of the common carotid artery. B. The external carotid artery. C. The internal carotid artery. a. The thyroid branch of the external carotid artery. b. The lingual artery. c. The facial artery. d. The submental branch. e. The mastoid branch. f, f, f. The occipital artery. g. The auricular branch. h. The transverse artery of the face. i. A muscular branch to the zygomatic muscle and the orbicular muscle of the eyelids.

D. The subclavian artery in the inner part of its course. E. The subclavian artery in the third part of its course. F. The termination of the subclavian artery. G. The axillary artery. H. The commencement of the brachial artery. k. The thyroid axis from which issues three branches. l. The ascending thyroid branch. m. The ascending cervical branch. n. The transversalis humeri branch. o. The transversalis colli branch. p. The thoracico-acromial branch. q. The upper thoracic branch. r. The anterior circumflex branch. s. The posterior circumflex branch. t. The subscapular artery. v. The dorsal branch of the subscapular artery. w. Its continued branch. x. The long thoracic branch.

Plate 4.



J. Walsh del.

Printed by G. & J. Jones

William Fairland.

London: Printed by G. & J. Jones, in the Strand.

applied with the point of a hair pencil, "the arteries, instead of being contracted, as they had so uniformly been by the application of ammonia, were actually and sensibly dilated."* Again: "when the capillaries are stimulated by the direct rays of the sun, by the application of gentle friction, or of spirits of wine, the velocity of the blood in them is immediately increased."† The application of electricity has determined marked contractions in arteries, as has been observed by two Italian physiologists, Giulio and Rossi; and Sir E. Home succeeded in producing the same effect by irritating a neighbouring nerve. These direct proofs of the irritability of arteries derive additional support from several pathological facts. "The increased pulsation of the larger vessels supplying an inflamed part, sufficiently evinces their increased action."‡ Thus, if paronychia occur in one of the fingers, the corresponding radial artery will pulsate more strongly than that of the opposite hand. In cases of

* Eod. loco.

† Wilson Philip on the Vital Functions, p. 285.

‡ Thomson, loc. cit.

PLATE V.

Fig. 1. In this plate the external carotid artery and some of its branches are shown; these are seen at the inner and upper part of the neck, taking the course of the anterior edge of the sterno-mastoid muscle. A small part of the common carotid is also seen near its termination. The subclavian artery is also brought into view where it lies close above the middle of the clavicle. In order to expose the vessels, the skin, the platysma muscle, and the fascia of the neck, are dissected away.

No. 1. The occipital protuberance, where it gives attachment to the trapezius muscle. 2. The mastoid process giving attachment to the sterno-mastoid muscle. 3. The lobe of the ear. 4. The ramus of the jaw-bone. 5, 5. The lower border of the body of the jaw-bone. 6. The anterior fibres of the trapezius muscle inclining down to their insertion into the clavicle. 7. Part of the splenius muscle, seen in the interval between the trapezius and the sterno-mastoid. 8. The elevator muscle of the angle of the scapula. 9. The body of the sterno-cleido-mastoid muscle. 10. The great wing (cornu) of the tongue-bone (os hyoides). 11. The fibres of the mylo-hyoid muscle descending to their insertion. 12. The anterior belly of the digastric muscle, the rest being removed. 13. The fibres of the trapezius muscle descending towards the acromion and clavicle. 14. The posterior and middle scaleni muscles. 15. The sterno-cleido-mastoid muscle, where it overlays the omo-hyoid muscle. 16. The upper part of the omo-hyoid muscle proceeding to its insertion. 17. The lower part of the omo-hyoid muscle. 18, 19. Two of the divisions of the brachial plexus of nerves. 20. The anterior scalenus muscle, where it overlays the subclavian artery. 21. The clavicular origin of the sterno-cleido-mastoid muscle. 22. The sternal origin of the same muscle. 23. The thyroid gland. 24. The junction of the clavicle with the acromion process. 25. The body of the clavicle. 26. Part of the deltoid muscle. 27. A few fibres of the great pectoral muscle.

A, A. The external carotid artery running up by the edge of the sterno-mastoid muscle.

a. Superior thyroid artery (ramus thyroideus superior vel descendens), inclining downwards from the external carotid artery. b. The facial or labial artery (ramus facialis vel labialis), inclining upwards and inwards to its destination. c. Its submental branch. d. The transverse artery of the face. e. The termination of external carotid in the temporal, which proceeds upwards before the ear to reach the side of the head.

B. The right subclavian artery (arteria subclavia dextra), descending from under cover of the scalenus muscle, and then proceeding behind the clavicle to reach the axilla.

f. The supra-scapular artery (ramus supra-scapularis vel transversalis humeri). g. The posterior scapular artery (ramus posterior scapulæ vel transversalis colli).

Fig. 2. This dissection shows the origin of the common carotid and subclavian arteries at the right side from the brachio-cephalic artery, also the course of the vertebral artery and the deep cervical. In order to expose these parts fully, the clavicle, with the sterno-mastoid and trapezius muscles, are removed, also the scaleni muscles in the greater part of their extent, as well as the levator scapulæ, splenius, trachelo-mastoid, and complexus, with the intertransversales: we thus leave only the deep-seated muscles which lie close to the spine and at the basis of the skull.

No. 1. The superior oblique muscle. 2. The posterior rectus (major) muscle. 3. The inferior oblique muscle. 4, 4. The body of the sterno-cleido-mastoid muscle. 5, 5. The longus colli muscle. 6, 6. The semi-spinalis colli muscle. 7. Part of the middle scalenus muscle at its attachment to the first rib. 8. Part of the anterior scalenus muscle.

A. The brachio-cephalic artery, a little below its bifurcation. B. The common carotid artery, at its origin from the brachio-cephalic. C. The subclavian artery.

d. The thyroid artery or axis, giving origin, just as it rises from the subclavian, to three or four branches. e. The ascending thyroid artery (ramus ascendens vel inferior), passing upwards behind the common carotid artery to reach the thyroid gland. f. The ascending cervical artery, which is here truncated near its origin. g, g, g, g. The whole course of the vertebral artery upwards to the base of the skull; the turn which it makes in order to get to a level with the great foramen of the base of the skull is seen in the triangular space bounded by the obliqui and recti muscles. h. The branch which gives off the deep cervical and the superior intercostal arteries. i. Superior intercostal artery. k. The deep cervical artery (ramus profundus cervicis): it is exceedingly variable in its size, being sometimes very large, as in the present instance, at other times comparatively small; in the latter case, the descending branch of the occipital artery acquires a proportionate increase. l. The origin of the internal mammary artery.

hemiplegia the force is considerably diminished at the affected side, though it remains quite natural at the other; a proof that the arteries possess a power independent of the heart, and which is attributable to their irritability. The degree in which these two properties of arteries, elasticity and irritability, are manifested, differs according to the size of the vessels; the larger are more elastic, the smaller more irritable; and this latter property is more or less subjected to nervous influence.

The experiments of Dr. Thomson, above cited, cannot be considered as conclusive evidence that arteries are really irritable, at least in that sense in which muscles are known to be so. Even were it established that the capillaries are contractile on the application of stimuli, it would not follow that the arterial tubes which extend from the heart to these, are irritable or muscular. Pain is necessarily produced by irritating substances; pain and fear soon influence the circulation; the former will at first quicken it; the latter, from its depressing effect, will soon diminish its rapidity. Besides, it may be objected to all chemical agents, that they must act on the delicate tissues in which the vessels are enclosed, and upon their coats, if not upon their contents.

Whatever differences of opinion may exist on this much litigated subject, few will deny that arteries assist, in some degree, in carrying on the circulation; for we know that they appear before the heart in the human embryo; and in several of the lower animals, in which there is no heart, the vessels alone propel the fluids. In fishes there is no systemic ventricle; in reptiles the arteries contract, and propel the blood after the heart has been removed; and even in warm-blooded animals the blood has been observed moving freely in the capillaries, after all connexion with the heart had been cut off by a ligature on the aorta.* The circulation goes on in acephalous monsters, though they have not a heart. Inferences drawn from a consideration of the structure and functions of the lower animals cannot always be extended to those of more complex and perfect organisation, as the analogy between them may not be sufficiently close to warrant the application; but from a general view of what has been stated with regard to the circulating system, we may conclude, that when the heart exists, it exerts a decided influence on the circulation; that by its action the stream of blood in the arteries moves on, not continuously, but in jets; and that it flows uninterruptedly, though the leading arterial trunks have become ossified. The vessels also have a part to perform, as is evident from the fact that they can propel the blood after the heart has ceased to act; and so the heart and arteries may be considered as associated for the performance of a special function, each being to a certain extent endued with an independent power; one acting by direct propulsion, the others assisting by their vital force and elasticity.

There are few subjects within the range of physiological research which have received more attention than the circulation of the blood at different times within the last two centuries. Considered even by itself, and altogether apart from the practical deductions which follow from it,—and they are many,—it carries sufficient interest to awaken the curiosity of any inquiring mind; but when it is taken in its various relations to the actions and movements of the different parts of the animated fabric, and to those derangements and disturbances of vital action and living structures which constitute disease, we cannot over-estimate its importance. When we turn over those pages in the history of medicine, in which are traced the different phases and mutations of opinion which have been exhibited during the progress of those researches which, from the first dawn of rational notions upon this subject, have gradually led to a complete evolution of all the phenomena of the circulation, and to the ascertainment of a satisfactory explanation of most, if not all, of them: though pleased with the general result, and gratified to find that so much has been reclaimed from the dominion of error and of ignorance and added to the sum of useful knowledge, we can scarcely help exclaiming, How slow and gradual is the progress of improvement! “So slow is it,” to use the words of Dugald Stewart, “that we are often tempted to doubt, whether the reason of the species is progressive. When our attention is limited to short periods of time, and becomes absorbed by the discussions and controversies which have agitated those who from time to time obtained sufficient ascendancy to give the tone to their contemporaries,—when we dwell on the ebb and flow of opinion, as traced in the writings of those sectaries who abetted the views and supported the doctrines of rival teachers or contending schoolmen, a doubt may perchance start across the mind, as to the reality of the progress which is made, or even to question the utility of some of the inquiries which are entered into; but when we enlarge the field of view, and extend the scope of inquiry, so as to look over the works of two or more succeeding generations, the reality of the progress, and the certainty of improvement, become obvious.” It is now somewhat more than two centuries since Harvey gave to the world the results of his inquiries into the circulation

* Inquiry into the Laws of the Vital Functions, p. 219, by Wilson Philip.

of the blood. He was a native of Kent, having been born at Folkestone in 1578: he went through the usual course of education in Cambridge, and then removed to the Continent, in order to prosecute (with more effect than he could do at home) his professional studies, having for some time previously resolved to make medicine his profession. Fortunately, he bent his steps to Padua, attracted, doubtless, by the well-merited celebrity of Jerom Fabricius (generally known as Fabricius ab Aquapendente, from his birth-place,) the most eminent teacher of anatomy of his time. There he learned the principles of that science which his future life was destined to adorn: there he learned the advantages which result from the examination of the structure of lower animals, as well as that of man; and the necessity of tracing the growth of the different parts of the living system from their earliest stages to their full maturity. Fabricius attentively examined the development of the chick in the egg during the progress of incubation: he demonstrated the existence of valves in the veins; he inferred that they must exert some influence upon the blood contained within them, supposing it to be put in motion as a current. But there he stopped, as if the subject altogether eluded his research. When Harvey took it up, he found a few detached facts relative to the blood and its movements scattered in the writings of Cæsalpinus, Columbus, and of Fabricius, obscured by much that was hypothetical, or irrelevant, if not erroneous. Fabricius not only knew of the valves in the interior of the veins and of the heart, but he thought the subject so well deserving of attention, that he delineated them in a series of drawings exhibiting their position and form. The existence of the valves was previously known to Sylvius, who appears to have been the first that noticed them; but Fabricius indicated clearly their form and direction. In one plate we see the valves in the basilic, axillary, and cephalic veins, as well as a double valve at the conflux of the internal jugular with the innominate vein: in another plate he shows the three valves at the origin of the aorta; and in five drawings he demonstrates the arrangement of the valves in the veins of the lower extremity. There is one drawing which forcibly arrests the attention: one would think that had he dwelt upon the facts which it represents, taken in connexion with his knowledge of the structure of the valves, and of their direction, viz. all pointing towards the heart, he could scarcely have failed to have arrived at a correct knowledge of the course of the blood in these vessels; still, though he had the facts before him, he did not draw the conclusion from them. The drawing to which I allude, is one which gives a view of the arm of a living person, the veins being rendered turgent by a ligature placed above the elbow; a consideration of the fact would show that the course of the blood was from the fingers upwards along the arm in the direction of the heart; but even Fabricius, with all his knowledge of the structure of the vessels, failed in achieving that discovery which has immortalized his more fortunate pupil. I made the remark just now that Sylvius knew of the existence of the valves; I find, however, on referring to that part of Fabricius, in which he treats of the nature of the valves, and replies distinctly to the question, "*Ostiola venarum, quid?*" and then proceeds to treat of the form of the valves, "*ostiolearum forma*," that he conceived himself to be the discoverer of the valves, and that he was decidedly under the impression, when he wrote his book, that no one had demonstrated them before his time. He first saw the valves, as he says, with great delight in 1574: "*neque aliquis prius hæc viderit quam anno Domini septuagesimo quarto supra millesimum et quingentesimum quo a me summâ cum lætitiâ inter dissecandum observata fuere.*"

Having treated formally of the structure and form of the valves, he proceeds to consider their use, and there shows that he had no correct notion whatever of the course of the blood, or the uses of the valves: his inference was, that the current of the blood flowed from the heart to the different parts of the body and to the limbs, whilst in the arteries it moved to and fro, as if it possessed something like a flux and a reflux. Entertaining this opinion as to the course of the blood, he conceived that the valves were intended to break its force, and to retard it in its passage to the hands and feet; for if it went there in full stream it would unduly accumulate in the lower parts, and so leave the upper ones without sufficient means of nutrition: "*Eâ ratione, ut opinor, a naturâ genitæ (ostiolæ), ut sanguinem quadantenus remorentur, ne confertim et fluminis instar, aut ad pedes aut in manus et digitos universus influat colligaturque, duoque incommoda eveniant, tum ut superiores artuum partes alimenti penuriâ laborent, et pedes tumore perpetuo premantur.*" Farther on he speaks of varicose dilatation of veins, and repeats the opinion of the influence of the valves in retarding the flow of blood: "*Imo, quod et ipsæ varices non aliâ de causâ fiant nisi quia sanguis crassior in ostioliis diutius detentus, ostiola et venas dilatat.*" He conceived that they served no trivial purpose also in strengthening the veins: "*Usus non contemnendus ut scilicet robur indatur ipsis venis.*" But why, it may be asked, are not the arteries furnished with valves? Fabricius has recorded his answer; namely, that they are not required for the purpose of preventing distention, because the coats of these vessels are suffi-

ciently strong of themselves; nor are they wanted to retard the blood, for it but ebbs and flows: "Arteriis autem ostiola non fuere necessaria, neque ad distensionem prohibendam propter tunicae crassitiem ac robur, neque ad sanguinem remorandum quia sanguinis fluxus refluxusque perpetuo fiat."

I make these references and extracts, not for the purpose of putting forward gratuitously the oversights of a really eminent man, or in anywise of detracting from his merits; I do it merely for the purpose of directing the reader's attention to the actual state of knowledge as to matter of fact, and to opinion as to matter of inference relative to the circulation as it existed at the commencement of

PLATE VI.

Fig. 1. The ramifications of arteries which branch out in the muscles and tegument of the face are here shown. They are derived from various sources: the temporal and labial arteries are derived from the external carotid; the frontal and supra-orbital are offsets from the ophthalmic artery, which is a branch of the internal carotid; the infra-orbital artery comes from the internal maxillary; and the mental artery is derived from the dental artery, which also is a branch of the internal maxillary.

No. 1. The frontal muscle at the left side; at the right it is removed. 2, 2. The orbicular muscle of the eye-lids. 3, 3. The elevator muscle of the upper lip and nose at each side. 4. The elevator muscle of the upper lip. 5. The elevator muscle of the angle of the mouth. 6. The zygomaticus minor muscle. 7. The zygomaticus major muscle. 8. The parotid gland. 9. The masseter muscle. 10. Part of the buccinator muscle. 11. The depressor of the angle of the mouth. 12, 12. The depressors of the lower lip. 13, 13. The margin of the lower jaw-bone. 14, 14. The orbicular muscle of the mouth.

a. The supra-orbital branch of the ophthalmic artery. b, b. The anterior branches of the temporal artery. c, c. The temporal artery. d. The transverse artery of the face (ramus transversalis faciei). e, e. The facial or labial artery (ramus facialis vel labialis). f. A branch given to the masseter muscle. g. The coronary artery of the lower lip (ramus coronarius inferior). h. The coronary artery of the upper lip (ramus coronarius superior). i. The lateral artery of the nose (ramus nasalis lateralis); it is the termination of the facial artery. k. A superficial branch of the submental artery running upon the chin. l. The mental or superficial branch of the dental artery as it emerges from the foramen mentale in the lower jaw. m. The facial artery of the right side ascending towards the nose, where it assumes the name of lateral nasal artery. n. The infra-orbital branch of the internal maxillary artery as it emerges from the foramen infra-orbitarium. o. The superficial nasal branch of the ophthalmic artery. p. The palpebral branches of the ophthalmic artery.

Fig. 2. The internal maxillary artery and its branches are shown in this drawing: in order to expose these, the zygoma, the greater part of the masseter muscle, and part of the lower jaw, are removed. The dura mater is also brought into view by the removal of part of the pericranium and skull, in order to expose its principal artery, viz. the middle meningeal.

Nos. 1, 1, 1, 1. The arch of the skull divided by a vertical incision; a horizontal incision is made through it above the ear and the orbit: this piece being removed, the dura mater, 2, 2, 2, with its branching artery, is seen. 3. Part of the temporal muscle. 4, 4. The orbicular muscle of the eye-lids. 5, 5. The two extremities of the zygoma, where they are divided by the saw in order to allow the removal of the intervening piece. 6. Part of the external pterygoid muscle. 7. Part of the internal pterygoid muscle. 8. The ramus of the lower jaw-bone where it is sawed through. 9. The lower part of the masseter muscle, the rest being removed with the zygoma. 10. The buccinator muscle. 11. Part of the duct of the parotid gland. 12. The elevator muscle of the lip and nose. 13. The elevator muscle of the upper lip. 14. The zygomaticus minor muscle. 15. The zygomaticus major. 16, 16. The upper and lower attachments of the depressor of the angle of the mouth. 17, 17. The orbicular muscle of the lips. 18, 18. The upper and lower attachments of the depressor muscle of the lower lip, the intervening part being taken away in order to expose the mental artery.

A. The external carotid artery ascending to its point of division into the temporal and internal maxillary arteries. B, B. The internal maxillary artery in its deep and tortuous course. C, C. The temporal artery.

a. A small branch to the masseter muscle. b. A branch to the parotid gland, which is here cut off. c. The posterior auricular artery. d. Another auricular artery. e. A pterygoid branch going into the internal pterygoid muscle. f. The dental artery (ramus dentalis inferior), descending to reach the canal in the lower jaw-bone. g. The buccal artery (ramus buccalis). h. The superior dental or alveolar artery. i. An anterior deep temporal branch. k. The posterior deep temporal branch. l. The middle meningeal artery ascending to the base of the skull. 1*, 1*, 1*. The branches of this vessel ramifying in the dura mater. m. A tympanic branch.

C, C. The temporal artery ascending in front of the ear.

n. An anterior auricular branch derived from the temporal artery; its superficial branches have been indicated in fig. 1.

D. The facial or labial artery.

o. A branch to the buccinator muscle. p. The continuation of the facial artery running up to the angle of the mouth. q. The same vessel passing under the zygomatici and ascending under the side of the nose. r. The coronary artery of the lower lip. s. A deep branch to the muscles of the lower lip, which anastomoses with the mental artery. t. The mental artery (ramus mentalis).

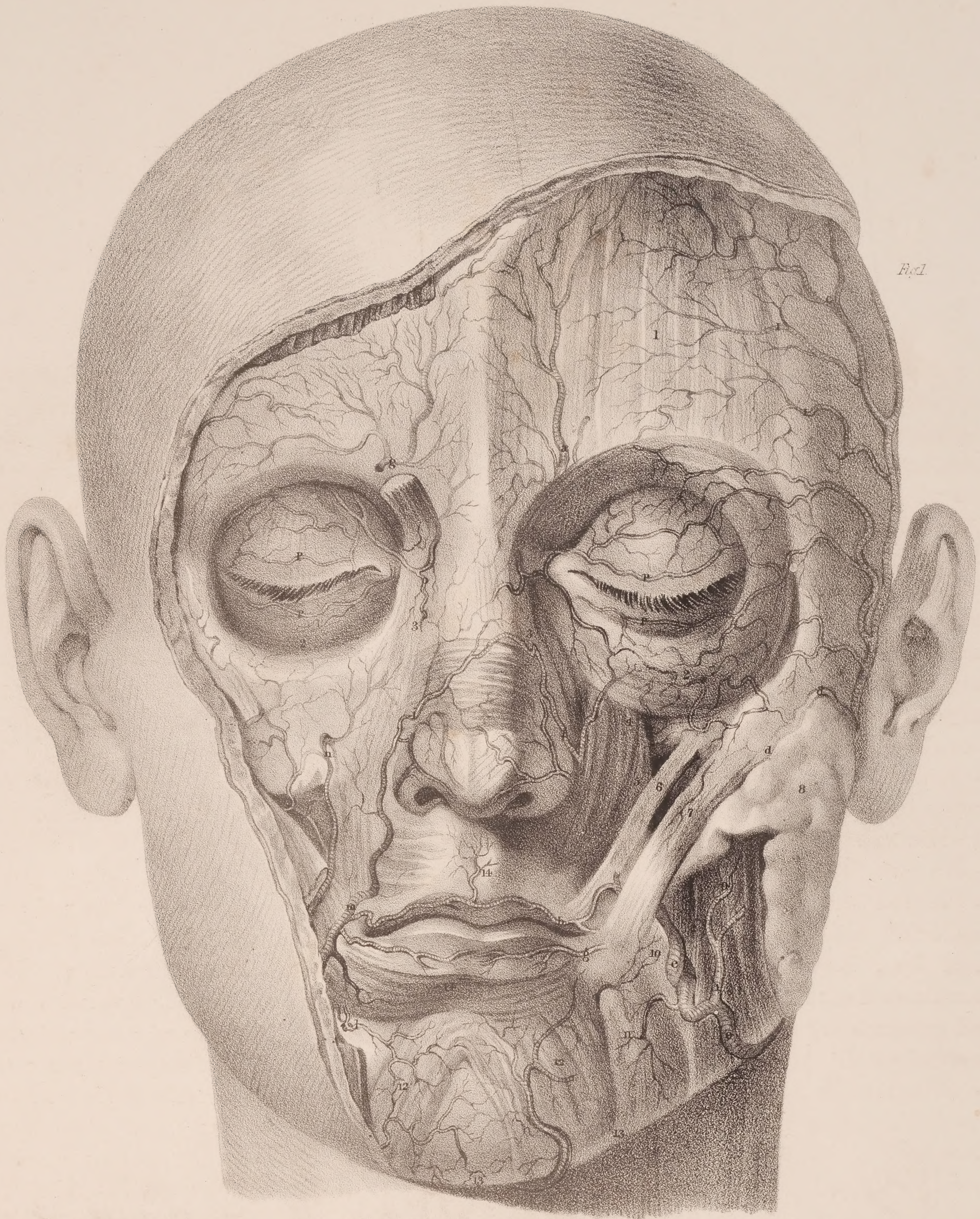


Fig. 4.

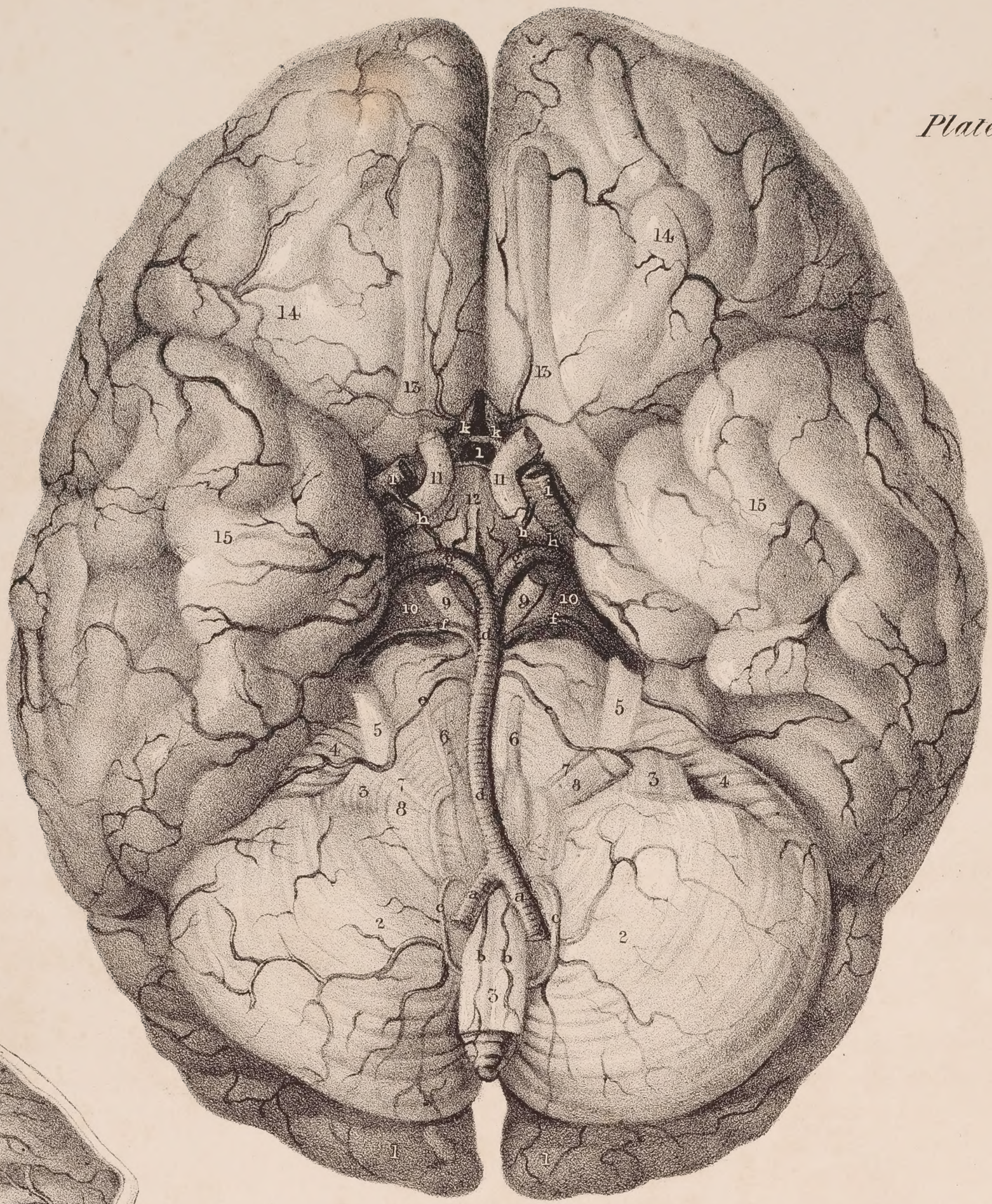


Fig. 7.



Fig. 6.

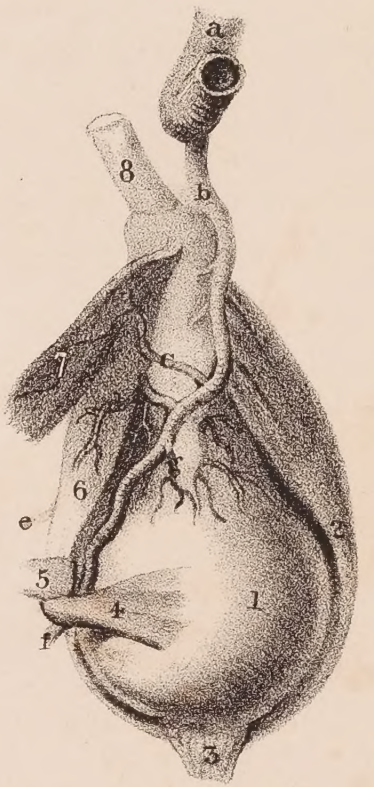


Fig. 5.



Fig. 3.

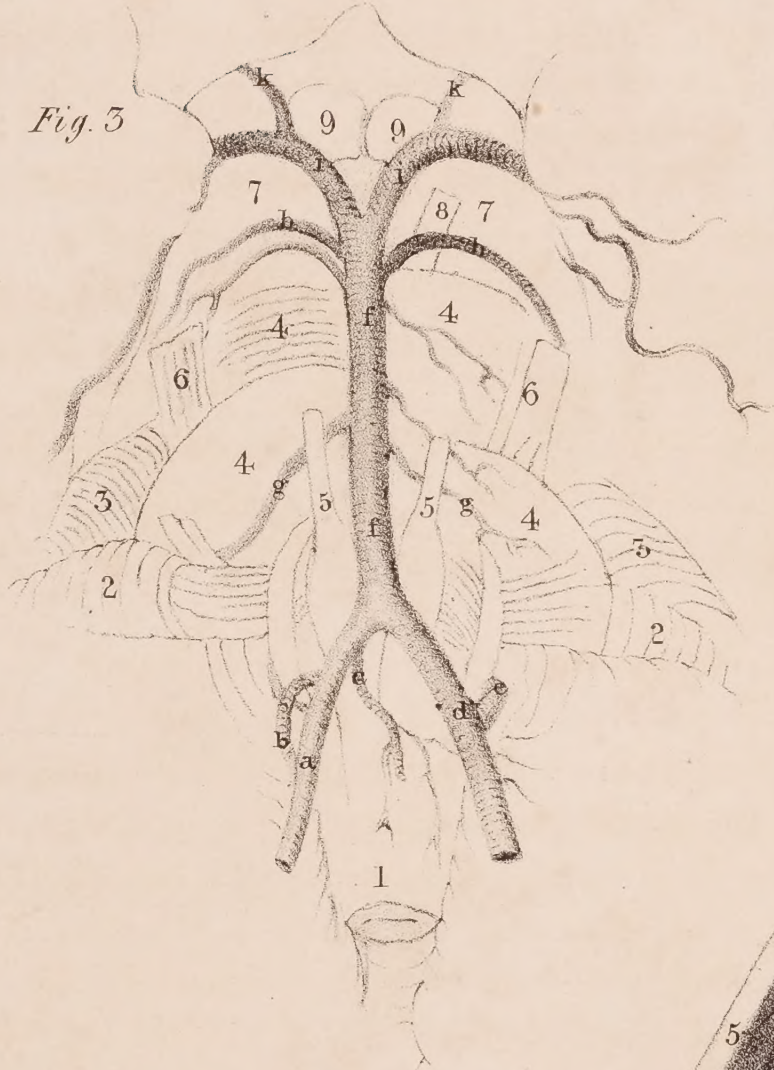


Fig. 1.



Fig. 2.



Harvey's career, and up to the moment in which he published his celebrated dissertation on the circulation, and which was entitled, "*Exercitatio anatomica de motu cordis et sanguinis in animalibus.*" It occurred to me that it could only be done with fairness to all parties, by setting before the reader the doctrine as it was taught by one of the best informed men and the most distinguished teacher of the time. It is frequently said, that though the greater or systemic circulation was altogether unknown before Harvey's time, still the smaller or pulmonic circulation was known and distinctly

PLATE VII.

Fig. 1. The lingual artery is here shown in its entire extent; also some of the branches of arteries on the septum of the nose and the palate.

No. 1. Frontal bone. 2. Crista galli. 3. The body of the sphenoid bone. 4. Its sinus. 5, 5. The nasal bone and cartilage divided. 6, 6. The septum of the nose. 7, 7. The superior maxillary and palate bones. 8. The upper lip. 9. The soft palate. 10, 10. The hard palate. 11. The lower lip. 12. The upper surface of the tongue. 13. Lower jaw-bone. 14, 14. The genio-hyo-glossus muscle. 15. The hyo-glossus muscle. 16. Part of the stylo-glossus. 17. The genio-hyoideus muscle. 18. The mylo-hyoideus. 19. Part of the sterno-hyoid muscle. 20. Part of the omo-hyoid muscle. 21. The anterior part of the thyroid cartilage. 22. Thyro-hyoid muscle. 23. Part of the lower constrictor muscle.

A. The common carotid artery. B. The external carotid artery. C. The internal carotid artery.

a. The superior thyroid artery. b. Its superior laryngeal branch. c. The lingual artery. d. The dorsal branch given to the root of the tongue. e. The hyoid branch. f. The sublingual branch. g. The ascending part of the lingual artery. h. Its terminal part, usually called ranine artery. i. The labial or facial artery cut off. k. The external carotid artery cut off also. l. The palatine artery ramifying on the palatine arch. m. Branch of the posterior nasal artery ramifying on the septum of the nose. n. Branches of the ethmoidal artery derived from the ophthalmic. o. A branch of communication which passes down through the incisor foramen to the palate.

Fig. 2. The three upper ribs, with parts of the sternum and of the spinal column, retained, in order to show the upper intercostal and the internal mammary artery: the parts are seen as within the cavity of the thorax.

No. 1. The body of the last cervical vertebra. 2, 3, 4, 5, 6. The bodies of the upper dorsal vertebræ. 7, 8, 9, 10, 11. The heads of the upper ribs. 12, 13, 14. The bodies of the three upper ribs. 15, 15, 15. The sternum, its inner surface. 16. The inner end of the clavicle. 17, 18, 19. Cartilages of the three upper ribs.

A. The subclavian artery.

a. The cut extremity of the artery. b. The vertebral artery near its origin. c. A small trunk which gives origin to the first intercostal and the deep cervical arteries. d. The deep cervical artery. e. The trunk of the first intercostal artery turning down upon the first rib. f. The branch which occupies the first intercostal space. g. The branch which occupies the second intercostal space. h, h. Two dorsal branches, which penetrate the intercostal spaces, and reach the deep muscles of the back. i, i. Branches of communication between the first intercostal and the intercostals which come from the aorta. k. The first intercostal branch derived from the aorta. l. Its continuation, running in the first intercostal space. m. The second intercostal branch derived from the aorta. n. The internal mammary artery. o, p. The two first anterior intercostal branches derived from the internal mammary artery. q, q. The inner or sternal branches.

Fig. 3. This drawing shows the basilar artery, formed by the conjunction of the two vertebral arteries, and terminating by giving off branches to the cerebellum and brain.

No. 1. The medulla oblongata. 2, 2. The small lobules of the eighth nerve. 3, 3. The anterior border of the cerebellum. 4, 4, 4, 4. The pons varolii. 5, 5. The sixth pair of nerves. 6, 6. The fifth pair of nerves. 7, 7. The crura cerebri. 8. The third pair of nerves. 9, 9. The mammillary bodies.

a. The right vertebral artery, which is here smaller than that of the opposite side. b. The posterior inferior branch given to the cerebellum. c. The anterior artery of the medulla spinalis. d. The left vertebral artery. e. The posterior and inferior branch to the cerebellum. f, f. The basilar artery. g, g. The anterior inferior arteries of the cerebellum. h, h. The superior arteries of the cerebellum. i, i. The posterior cerebral arteries. k, k. The communicating arteries.

Fig. 4. The arteries of the base of the brain are here seen.

No. 1, 1. The posterior lobes of the brain. 2, 2. The lobes of the cerebellum. 3, 3. The lobules of the eighth nerve, so called by Reil. 4, 4. The anterior border of the cerebellum. 5, 5. The fifth nerves. 6, 6. The sixth nerves. 7, 8. The facial and auditory nerves. 9, 9. The third nerves. 10, 10. The crura cerebri. 11, 11. The optic nerves. 12. The tuber cinereum and infundibulum. 13, 13. The olfactory nerves. 14, 14. The anterior lobes of the cerebrum. 15, 15. The middle lobes of the brain.

a, a. The two vertebral arteries. b, b. The anterior arteries of the medulla spinalis. c, c. The posterior inferior arteries of the cerebellum. d, d. The basilar artery. e, e. The anterior inferior arteries of the cerebrum. f, f. Superior arteries of the cerebellum. g, g. The posterior cerebral arteries. h, h. The two communicating arteries. i, i. The trunks of the internal carotid arteries. k, k. The anterior cerebral arteries. l. The communicating artery between them.

Fig. 5. The ophthalmic artery within the orbit.

No. 1. Part of the upper eye-lid. 2. The elevator muscle of the upper eye-lid. 3. The lachrymal gland. 4. The superior oblique muscle. 5. The external rectus muscle. 6. The optic nerve.

a. The trunk of the internal carotid artery. b. The ophthalmic artery. c. Its lachrymal branch, going to the

described by two or three different persons; by Servetus, and still more distinctly by Columbus and Cæsalpinus: it is obvious that they knew that the blood could not pass from the right to the left cavity of the heart directly, inasmuch as there is no perforation in the partition between these cavities in their natural condition; if so, it must pass from the one to the other by going a devious course through the lungs: but if we refer to Fabricius, who is evidently well acquainted with all that was known upon these topics in his day, and who saw them through the medium in which they were presented by these authors themselves in their own works, or by their pupils and followers, but who saw them unaided by the additional light which was soon thrown upon the subject by the publication of Harvey's researches, we shall see that even upon this point there existed little more than a glimmering of knowledge. Fabricius, in common with others, knew of the existence of three orders of vessels within the lungs, viz. the trachea, the arterious vein (pulmonary artery), and the venous arteries (pulmonary veins): he knew that the air entered the lungs by the trachea; but he supposed that it was carried from thence, to the left side of the heart, by the pulmonary vein, in order to be converted into vital spirits, and also to cool the heart, whilst the pulmonary artery conveyed a pure blood for the nutrition of the lungs:—

“Pulmones, cum publicum usum corpori præbent, tria illa vasorum genera in sui substantiam disseminata, scil. asperam arteriam, venam arterialem, et arteriam venalem, hoc modo administrant. Per asperam arteriam, aerem respiratione attractum primo rapiunt et recipiunt, qui postea a cordis pulsu per arteriam venalem in sinistrum cordis sinus defertur concoquendum et in spiritum vitalem commutandum, refrigeriumque cordi præstandum. Per tertium vero vas, quod vena arterialis dicitur, pulmones purissimo tenuissimoque sanguine enutrientur.” — *Fabricii Opera Anatomica*, p. 78, ch. viii.

When Harvey's book was published, the doctrines which it contained, and which were previously taught by him in his lectures for several years, were opposed as a violent innovation, which should be resisted as being altogether at variance with the doctrines taught by persons fully as competent as he could be to investigate facts and draw from them conclusions: not a few contended that it was a tissue of fallacy throughout; which is a sufficient proof that the doctrine was new, and, if tenable, deserved to be considered, as it has ever since been considered, one of the most important contributions to knowledge which the history of medicine records. When, however, the appeals which were made to experiment and observation, which arose on these points, could not be resisted, Harvey's opponents adroitly shifted their ground, and put forward the allegation that his doctrine was not new or peculiar to himself, inasmuch as numerous traces of it could be detected in the writings of the ancients. It was alleged that even Hippocrates was acquainted with the circulation; but even if the passage upon which this opinion was founded be considered, it will not furnish any intelligible notion as to the circulation as taught by Harvey: in the Latin translation it runs thus, “Venæ per corpus diffusæ, spiritum et fluxum ac motum exhibent, ab una multæ germinantes; atque hæc una, unde oriatur et ubi desinat, non scio; circulo enim facto principium non invenitur.” But even if we were for a moment to admit that the seeds of knowledge of this point of doctrine were to be found in this passage, or in any other that can be cited, it must be confessed that they remained altogether unproductive; inasmuch as the best informed men up to the commencement of the seventeenth century

lachrymal gland, and giving branches to the external rectus muscle and the eye-lid. d. Continuation of the ophthalmic artery after having passed the inner side of the orbit. e, e. Two ethmoidal branches. f. The tendon of the superior oblique muscle after having passed through its pulley. g. The dorsal artery of the nose. h. The palpebral branches.

Fig. 6. The trunk of the ophthalmic artery is here seen in its entire extent, the levator palpebræ and superior rectus being removed.

No. 1. The ball of the eye. 2. The external rectus muscle. 3. The tendon of the superior rectus cut across and drawn forwards. 4. The tendon of the superior oblique muscle. 5. The pulley through which it passes. 6. The body of the superior oblique muscle. 7. Part of the superior rectus muscle drawn inwards. 8. The optic nerve.

a. The trunk of the internal carotid artery. b. The ophthalmic artery continued onwards from it. c. One of its muscular branches. d. Another muscular branch. e. The supra-orbital branch. f. The infra-trochlear branch. g. The ciliary branches.

Fig. 7. The branches which ramify on the outer side of the nasal fossa are here shewn, the cavity being exposed by a vertical incision.

No. 1. The frontal bone. 2. The crista galli. 3. The body of the sphenoid bone. 4. Its sinus. 5, 6, 7. The turbinate bones. 8. The soft palate. 9, 9. The hard palate. 10. The upper lip.

a. Branches of the ethmoidal artery passing down on the turbinate bones. b. Branches of the posterior nasal artery ramifying in the upper meatus, and upon the upper spongy bone. c. Branches to the inferior meatus, to the tonsil, and soft palate.

failed to draw correct inferences from the facts before them, and, when they descended from vague generalities to special demonstrations, they supplied sufficient evidence to prove that their notions relative to the circulation were altogether erroneous.

I shall now proceed to describe the course of the different blood-vessels, beginning with the arteries.

The great artery, from which as from a common conduit all the other arteries issue, is called the aorta. In plate III. of the arteries, fig 1, it is marked A, A. In plate I. it is numbered 17, 18. A single glance at the drawing first referred to will show that this vessel is the main trunk of a series of tubes which convey red blood to the different organs of the body. It commences at the left ventricle of the heart, with which it is connected by the lining membrane on the inside, by the serous pericardium externally, and by a cellulo-fibrous ring, which extends from the indented border of its middle coat to the margin of the ventricle. From the ventricle the vessel extends as far as the fourth lumbar vertebra, where it divides into the common iliac arteries. But though it remains an undivided trunk to the point just indicated, different parts of it have received different names, from their position and relations, as well as to facilitate their description.

The aorta, the primary systemic artery, arises from the upper part or base of the left ventricle of the heart, where its margin is guarded by three semi-lunar valves, which prevent the reflux of blood projected into the vessel. At its origin it is not exactly cylindrical, for there are three small bulgings externally, corresponding with as many dilatations within, each lying external to one of the valves. These dilatations are named *sinus minores*, or sinus Morgagni. If a probe be passed directly backwards from the upper border of the fourth costal cartilage of the left side, at its junction with the sternum, it will impinge on the junction of the vessel with the ventricle; and if pushed further back, it will touch the fourth dorsal vertebra a little to the left of the median line. The aorta at its origin lies behind the pulmonary artery, which overlays it, and before the left auriculo-ventricular opening. Its course is at first upwards, forwards, and to the right side, until it gets on a level with the second costal cartilage; it then alters its direction, turning from right to left, becoming transverse, at the same time inclining backwards, being on a level with the second dorsal vertebra: but it soon makes another turn, and changes its direction so as to incline inwards and downwards upon the left side of the third dorsal vertebra, where the curved part of the artery (*arcus aortæ*) ceases.

Some persons restrict the term "arch" to the transverse portion (*crosse de l'aorte*). We, however, here apply it to the whole space included between the base of the ventricle and the lower border of the third dorsal vertebra; and between these points it will be observed that the artery describes a curve, whose convexity is directed upwards, forwards, and to the right side; the concavity, of course, in the opposite way. The terms "ascending" and "descending" aorta are not in strictness applicable to the conformation of the vessel in the human subject; they were adopted by some of the older anatomists, whose dissections were for the most part confined to inferior animals, in many of which the vessel, instead of forming a curve, divides into two trunks, one descending to supply the posterior parts, the other ascending to the head and anterior extremities. But in order to facilitate the description of the *arch*, and to mark more precisely its relations, it is convenient to consider it as divisible into three portions, an ascending, transverse, and descending.

The ascending part of the arch has before it, for a short way, the pulmonary artery, the right auricle also overlapping it; but as it ascends and comes forward, it approaches the sternum, from which it is separated by the pericardium and the cellular tissue lodged in the mediastinum. Posteriorly, it is supported by the right branch of the pulmonary artery; on its right, lies the descending vena cava; on the left, the pulmonary artery. This part, from two inches to two and a quarter in length, is enclosed within the pericardium. The transverse part lies behind the sternum (at the junction of its first and second pieces), from which it is separated, at least in part, by the left brachiocephalic vein, which lies along its upper border, and overlaps it a little,—before the trachea, and above the bifurcation of the pulmonary artery, to which its concavity is connected by the ductus arteriosus: finally, at its left extremity, where it turns downwards, the vagus nerve crosses it in front, and the recurrent coils upwards and inwards behind it. The descending part of the arch, as it sinks backwards, recedes from view, having before it the left bronchus and left pulmonary artery, behind it the body of the third dorsal vertebra, to the right the œsophagus and thoracic duct, and to the left the pleura, which is reflected upon it. If the pulmonary artery be cut across at its root and drawn upwards, it will be seen that the curve of the aorta in a manner encloses the right pulmonary artery, the left bronchus, the left auricle, the ductus arteriosus, and the recurrent nerve.

Aorta—its branches.—The branches given off by the arch of the aorta are five in number, viz. two

to the heart, and three which supply the upper extremities, with the head and neck. The branches which go to the heart are called coronary (à *corona*), from the manner in which they encircle the base of the ventricles; and cardiac, (*καρδία*, the heart,) from their destination. They are named, the one right, the other left, from their direction. The other branches are, the brachio-cephalic or arteria innominata, which is distributed to the right upper extremity, and the corresponding side of the head and neck, the left carotid, and the left subclavian.

The description of the coronary arteries shall be given with that of the heart itself, as they are its proper nutritious vessels. I proceed to the larger vessels in their order.

Brachio-cephalic artery (plate I. No. 19; plate III. fig. 1, B.)—The brachio-cephalic artery (a. brachio-cephalica, innominata) is a short trunk, which divides so as to supply the right upper extremity and the corresponding side of the head and neck; hence its name. There is no sufficient reason for continuing to call it the “unnamed” artery, when, so far from being unnameable, it has received a very appropriate name. Its diameter is greater than that of either of the vessels which arise from the arch of the aorta; its origin is at the junction of the ascending with the transverse parts of the arch, from which point it passes obliquely upwards, and to the right side, until it reaches the sterno-clavicular articulation, where it divides into the right subclavian and right carotid arteries. Its length is generally from an inch to an inch and a quarter; but in some cases it is a little longer, and ascends higher into the neck; its point of bifurcation may be transfixed by a probe passed backwards through the cellular interval between the sternal and clavicular portions of the sterno-mastoid muscle. This artery lies behind the first bone of the sternum, from which it is separated above by the sterno-hyoid and sterno-thyroid muscles, and below by the left brachio-cephalic vein, which crosses it. It rests on the trachea, over which it passes obliquely; to its right side is the right brachio-cephalic vein, and to the left the thymus gland, or the cellular tissue, into which it degenerates. No branches arise from this vessel in their ordinary or regular distribution: whenever any are seen to issue from it, they are found to be some which ordinarily come from other sources; for instance, the left carotid, or the thymic or inferior thyroid.

Common carotid artery (plate I. No. 20—27, plate IV. A, A.)—The two vessels of this name, (a. carotides communes vel primitivæ,) whilst in the neck, are, as nearly as may be, similar in their course, size, and relations; but they differ in their length and mode of origin. The vessel on the right side commences opposite the sterno-clavicular articulation, being the point at which the brachio-cephalic divides into the carotid and subclavian arteries, whilst that of the left arises from the arch of the aorta, and is necessarily longer, and at first more deeply seated. That portion of the left carotid which intervenes between the arch of the aorta and the sterno-clavicular articulation is covered by

PLATE VIII.

The arteries of the back of the shoulder are here shown: in order to expose them, the deltoid muscle is reflected from its origin and drawn downwards, the trapezius is detached from its insertion and carried backwards, the rhomboidei and infra-spinatus are cut through and part removed.

No. 1, 1. The upper extremity of the trapezius muscle. 2, 2, 2. The trapezius muscle reflected and drawn to the left side. 3. The sterno-mastoid muscle. 4. The splenius capitis. 5. The splenius colli. 6, 6, 6. The elevator muscle of the angle of the scapula: it appears here as if it consisted of two fasciculi. 7. The lower part of the sterno-mastoid muscle. 8. Part of the serratus posticus superior. 9. The rhomboideus minor muscle. 10. The rhomboideus major. 11, 11. The vertebral aponeurosis. 12. The clavicle. 13. The acromion process. 14. The spine of the scapula. 15. Part of the infra-spinatus muscle. 16. The great tuberosity of the humerus. 17. The teres minor muscle. 18. The long head of the triceps extensor muscle. 19. The teres major muscle. 20. The deltoid muscle. 21, 21, 21. The great serratus muscle. 22. Part of the latissimus dorsi muscle.

a. The occipital artery where it ascends and becomes superficial. b, b. The transversalis colli artery where it turns backwards under the levator scapulæ. c, c, c. The descending part of the artery where, from its relation to the base of the scapula, it assumes the name of posterior scapulæ. d. The deep cervical artery. e. Its posterior or muscular branches. f. A branch from the transversalis colli, which descends to the supra-spinous fossa. g. A muscular branch distributed to the supra-spinatus and the trapezius. h. A branch which goes towards the clavicle and acromion. i, i. The transversalis humeri artery descending towards the dorsum of the scapula. k. The same vessel lower down, where it is covered by the infra-spinatus muscle: this situation it reaches by passing between the anterior border of the spine of the scapula, and the margin of the glenoid cavity: from its relation to the scapula, it is called the supra-scapular artery. l. The branches of arteries upon the acromion process forming a free anastomosis. m. The posterior circumflex artery. n, n. The dorsal branches of the sub-scapular artery. o, o. Penetrating branches derived from the intercostal arteries. p, p, p. Branches also derived from the intercostal arteries.



William Fairland del.

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London, John Taylor, Upper Gower St.

Plate 9.

Fig. 1.

Fig. 2.



J. Walsh del.



William Fairland lith.

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the upper part of the sternum by the muscles arising from its posterior aspect, and is crossed by the brachio-cephalic vein of the left side ; posteriorly, it corresponds to the trachea, to the œsophagus (which, in this situation, deviates to the left side), and the thoracic duct. The description of the cervical portion of one artery will suffice for both.

The common carotid artery ascends obliquely upwards and outwards, its direction coinciding with that of a line drawn from the sterno-clavicular articulation to midway between the angle of the

PLATE IX.

In these drawings the arteries of the arm, fore-arm, and hand are shown, as they lie along the anterior aspect of the limb. In the first figure the skin and fascia only are removed ; in the second, some of the superficial muscles are cut away to bring the deep vessels into view.

Fig. 1. No. 1. A small part of the great pectoral muscle near its insertion. 2. Part of the deltoid muscle. 3. The upper part of the biceps flexor muscle. 4. The coraco-brachial muscle. 5. The long head of the triceps extensor muscle. 6. The middle part, or fleshy body, of the biceps flexor muscle. 7. The fibrous layer (inter-muscular septum) which separates the muscles on the fore part from that on the back part of the humerus. 8. The short head of the triceps extensor muscle. 9. The lower part of the brachialis anticus muscle. 10. The tendon of the biceps flexor muscle, dipping down between the muscles of the fore-arm to reach its insertion. 11. A fibrous layer or process which passes off from the tendon just named, and covers over the brachial artery at the bend of the fore-arm. 12. The pronator radii teres muscle. 13. The inner condyle of the humerus. 14. The long supinator muscle of the radius. 15. The lower part of the pronator teres muscle where it is passing to its insertion and becomes crossed by the radial artery. 16. The flexor carpi radialis muscle. 17. The fleshy part or body of the palmaris longus muscle. 18. The fleshy part or body of the flexor carpi ulnaris muscle. 19. A small part of one of the extensor muscles (scil. carpi radialis longior). 20. The tendon of the long supinator muscle. 21. The tendon of the flexor carpi radialis. 22. The tendon of the palmaris longus. 23. Part of the superficial flexor muscle of the fingers. 24. The tendon of the flexor carpi ulnaris. 25. Part of the tendon of the extensor muscle of the first phalanx of the thumb. 26. The tendon of the extensor muscle of the metacarpal bone of the thumb. 27. A small part of the tendons of the deep flexor muscle of the fingers. 28. Part of the tendon of the superficial flexor muscle of the fingers. 29. The tendon of the flexor carpi ulnaris muscle where it becomes inserted into the pisiform bone. 30. Part of the opponens pollicis muscle. 31. The abductor muscle of the thumb. 32. Part of the short flexor muscle of the thumb. 33. Part of the palmar fascia. 34. The palmaris brevis muscle. 35. The tendon of the long flexor muscle of the thumb. 36. Part of the adductor muscle of the thumb. 37. The abductor muscle of the fore-finger. 38, 38, 38, 38. The four lumbricales muscles. 39, 39, 39, 39. The tendons of the superficial flexor muscle of the fingers. 40. The fibrous bands which bind down the flexor tendons as they run along the digital bones of the fore-finger : in the other fingers they are removed in order to show the flexor tendons. 41, 41, 41, 41. The tendons of the deep flexor muscle of the fingers passing to their insertions.

A, A. The brachial artery (*arteria brachialis vel humeralis*).

a. Small muscular branch given to the triceps muscle. b. A branch to the coraco-brachialis muscle. c. The superior deep branch (*arteria profunda humeri*). d. A branch to the triceps muscle. e and f, are branches also given to the triceps muscle : one of these is usually larger than is here represented, and descends to the inner and back part of the elbow-joint, where it assists in keeping up a free communication with branches derived from the vessels of the fore-arm ; it is then called the inferior deep branch (*arteria profunda inferior*). g and h, are muscular branches to the biceps and brachialis anticus muscles. i, is a muscular and communicating branch usually named *ramus anastomoticus*. k. A muscular branch to the brachialis anticus and pronator teres.

B, B. The radial artery (*arteria radialis*).

l. Its recurrent branch (*ramus recurrens*). m. A muscular branch to the pronator and flexor muscles. n, n, n, n. Muscular branches from the outer side of the artery as it passes along the fore-arm. o. Its superficial palmar branch (*ramus superficialis volæ*), which assists in forming the palmar arch of arteries.

C. The ulnar artery (*arteria ulnaris*) in the lower part of the fore-arm ; higher up it is concealed by the muscles.

D, D. The superficial arch formed in the palm of the hand by the termination of the ulnar artery, joined by the *superficialis volæ* branch of the radial artery. p, q. The collateral branches of the thumb. r. The first collateral branch of the fore-finger. s. A small muscular branch given off by the ulnar artery to the muscles at the inner side of the palm of the hand. t, t, t, t. The digital branches derived from the palmar arch : each will be observed to divide into two offsets (u, u) at the roots of the fingers, which run along their borders, forming their collateral branches.

Fig. 2. No. 1. Part of the coraco-brachialis muscle. 2. The long head of the triceps muscle. 3. The brachialis anticus muscle. 4. The internal inter-muscular ligament. 5. The inner head of the triceps muscle. 6. The long extensor muscle (scil. *extensor carpi radialis longior*). 7. The lower part of the brachialis anticus muscle at its insertion into the coronoid process of the ulna. 8. The inner condyle of the humerus. 9. Part of the flexor carpi ulnaris muscle ; the rest, together with the flexor muscles arising from the inner condyle, being cut away to expose the ulnar artery. 10. The short extensor muscle (*extensor carpi radialis brevior*). 11. Part of the supinator brevis muscle. 12. The upper part of the ulna. 13. The insertion of the pronator teres. 14, 15. The long flexor of the thumb. 16, 16, 16. The inter-osseous ligament. 17. The pronator quadratus muscle. 18. The wrist-joint, — its anterior radio-carpal

jaw and the mastoid process. Opposite the upper border of the thyroid cartilage, the vessel divides into two great branches, of which one is distributed by its ramifications to the cranium and face, the other to the brain and the eye; hence, from their destination, they are named the external and internal carotid arteries. The common carotid artery is covered below by the skin and fascia, also by the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and crossed by the omo-hyoideus opposite the upper rings of the trachea, or the lower border of the cricoid cartilage. But from this point to its bifurcation the vessel is covered only by the skin, platysma, and fascia, owing to the fact that the sterno-mastoid and omo-hyoideus, by diverging to their respective destinations, cease to cover it, and so leave it comparatively superficial. It has behind it the vertebral column, from which, however, it is separated by the longus colli and rectus anticus muscles, and inferiorly by the recurrent laryngeal nerve and inferior thyroid artery. The inner side of the vessel is in close relation below with the trachea, higher up with the thyroid gland (which often overlaps it), the larynx, and pharynx; along its external side are placed the internal jugular vein and the vagus nerve, the latter being behind and between both vessels. The artery will be found enclosed in a sheath, composed of condensed cellular membrane, which forms an investment common to it, the internal jugular vein, and the nervus vagus. The descendens noni nerve usually rests on the fore part of the sheath; but in some instances part of the arch of anastomosis formed by this nerve will be found within the sheath, lying between the artery and vein. The sympathetic nerve lies between the sheath and the rectus anticus muscle.

If the subject be turned on its back, the two carotids will be seen separated, at the root of the neck, only by the interval between the sterno-clavicular articulations, but as they ascend they diverge, still they do not pass backwards, as may at first sight be supposed from viewing the parts in this position; their greater apparent depth at the upper than at the lower part of the neck is caused by the projection forwards of the larynx and os hyoides, which often protect them in attempted suicide. They send off no branches, and therefore retain their size undiminished as far as the upper border of the thyroid cartilage, where each divides into the external and internal carotid arteries.

External Carotid artery (plate II. C, plate IV. B, plate V. fig. 1, A, A).—This vessel (a. carotis externa), smaller than the other in infancy, but of equal size in adult age, extends, from the point of division above indicated, to the neck of the condyle of the jaw, or a little lower, where it divides into the temporal and internal maxillary arteries. At first it lies before and to the inner side of the internal carotid, but soon crosses it, inclining backwards; after which it curves somewhat as it ascends to its point of division. For a quarter of an inch after its origin it is covered only by the skin, platysma, and fascia; it is then crossed by the stylo-hyoid and digastric muscles, also by the lingual nerve, and finally becomes embedded in the parotid gland. The stylo-glossus and stylo-pharyngeus muscles, with the glosso-pharyngeal nerve, run between it and the internal carotid artery, and support it, at least partially, until it reaches the gland, in the substance of which the artery is crossed by the portio dura, which is placed superficially to it. It gives off eight branches, including the pair into which it ultimately divides, which may be arranged into sets as follows:—1. The anterior branches, consisting of the superior thyroid, the lingual, and the facial. 2. The posterior set, viz. the occipital and posterior auris. 3. The internal, being the pharyngea ascendens. 4. The terminal ones, which are the temporal and internal maxillary.

Thyroid artery (plate II. e, plate IV. a, plate V. fig. 1, a).—This branch (a. thyroidea superior, vel descendens) is given off close to the commencement of the external carotid, immediately below the

ligament. 19, 19. The inner and outer extremities of the anterior annular ligament of the wrist; the intervening part being removed. 20. The abductor muscle of the little finger. 21. The opponens muscle. 22, 22, 22, 22. The interossei muscles.

A, A. The brachial artery.

a. Muscular branches to the triceps muscle. b. Offsets to the coraco-brachialis. c. The superior profunda artery. d. The inferior profunda artery. e, f, g, h. Muscular branches. i. The anastomoticus branch. k. A muscular branch.

B, B. The radial artery.

l. Its recurrent branch. *m, m. Muscular branches. n. Its superficial palmar branch (ramus superficialis volæ). o. Its digital branch (arteria magna, vel princeps pollicis), dividing to supply both sides of the palmar aspect of the thumb.

C, C. The ulnar artery.

p. Its recurrent branch. q. A small branch to the muscles of the little finger. r. The deep branch, which joins with the termination of the radial artery, and completes the deep palmar arch (2). s. The first collateral branch of the fore-finger. t, t, t, t. The interosseous branches derived from the deep palmar arch. u, u, u, u. The bifurcation of the digital branches of the fingers, derived from the superficial palmar arch: the palmar interosseous branches just noticed will be observed to join these at their points of bifurcation.

cornu of the os hyoides, and inclines downwards and inwards, somewhat in a serpentine manner, to the upper border of the thyroid cartilage. It then descends a little to reach the thyroid gland, and divides into three branches, one of which runs transversely to anastomose with the corresponding vessel of the opposite side, whilst the others ramify freely in the substance of the gland, and communicate with the ascending thyroid branch of the subclavian artery. The vessel is at first covered only by the platysma and fascia. Previously to its division into the proper thyroid, or terminal branches here noticed, it gives off the following :

The hyoid branch (*ramus hyoideus*)—a branch which passes just below or upon the os hyoides, and forms an arch with its fellow of the opposite side, sending at the same time ramusculi to the adjacent muscles and integuments.

r. Descendens superficialis passes down, and divides into several ramusculi, which supply the thyroid muscles, the sterno-mastoid, the platysma, and integument.

r. Laryngealis inclines inwards with the superior nerve of the same name, and in most instances pierces the thyro-hyoid membrane, but in some it passes through a foramen in the thyroid cartilage. In either case, on reaching the inside of the larynx, it divides into ramusculi, which take different directions for the supply of the small muscles and lining membrane of the organ.

Lingual artery (plate IV. b, plate VII. fig. 1, c, c). — This branch (*a. lingualis*) inclines forwards and inwards to the upper margin of the cornu of the os hyoides, where it passes between the hyoglossus and the middle constrictor of the pharynx. So far the direction of the vessel is horizontal, but it soon ascends almost perpendicularly, being covered by the digastric, mylo-hyoid, and genio-hyoid muscles ; and finally changes its course, to run directly forwards beneath the tongue, where it assumes the name of ranine artery. Its branches are the following :

The hyoid branch (plate VII. fig. 1, e) takes the direction of the os hyoides, running on its upper border, and forming an arch by anastomosis with the corresponding vessel of the opposite side ; it gives ramusculi to the contiguous muscles and the tegument.

The dorsal branch of the tongue (*r. dorsales linguæ*, plate VII. fig. 1, d). — One or two branches arise where the artery is deeply seated, and incline backwards and upwards, covered by the hyoglossus muscle. These are called the “dorsal” branches, from their destination, for they supply the substance and upper part of the tongue, ramifying as far back as its root. At the anterior border of the hyo-glossus the lingual artery may be said to divide into the ranine and sublingual arteries.

The ranine branch (*r. raninus*, plate VII. fig. 1, h), in direction, is its proper continuation ; it proceeds forwards beneath the lingualis muscle, and close to the outside of the genio-hyo-glossus ; and, finally, near the tip of the tongue, forms an arch, by anastomosing with the corresponding artery of the opposite side. The ranine arteries of opposite sides are placed at each side of the frænum linguæ, under cover only of the mucous membrane.

The sublingual branch (*r. sublingualis*, plate VII. fig. 1, f) passes between the mylo-hyoid muscle and the sublingual gland, giving branches to both ; one also reaches the chin, where it ramifies in small ramusculi. In its course it supplies the sublingual gland, as well as the muscles passing from the chin and jaw to the tongue ; its size varies in different instances, so does its origin, for it often comes from the submental branch of the facial.

Facial artery (plate IV. c, plate VI. fig. 1, e, e, and fig. 2, D). — This vessel (*a. facialis*, *labialis* ; *maxillaris externa*) extends from the carotid artery, along the side of the face, towards the root of the nose. It is usually the largest of the anterior branches, and arises higher up than the lingual. It ascends in rather a winding course, so as to get deeply under cover of the jaw-bone, and then inclines down, running in a groove in the upper surface of the submaxillary gland, as far as the margin of the jaw, over which it turns, to reach the side of the face. In its ascent, the artery is concealed by the platysma, the tendon of the digastricus, and the stylo-hyoideus ; but where it rests on the external surface of the jaw-bone, it is covered only by the integument and platysma, lying close to the anterior border of the masseter, where its pulsation can readily be felt. The artery then ascends, inclining towards the angle of the mouth ; it rests on the buccinator muscle, and is crossed by the zygomatici. And, finally, becoming much diminished in size by having given off several branches, it ascends under the name of *ramus angularis* by the side of the nose, covered by the common elevator muscle, and terminates at the angle of the eye by two or three very small ramusculi, which anastomose with the nasal branches of the ophthalmic artery.

Its branches are numerous, and may conveniently be divided into two sets ; the first consisting of those given off before the vessel reaches the jaw, being usually three or four ; the second of those distributed to the face, varying from five to six, as follows :

The inferior palatine branch (*ramus palatinus inferior*) ascends between the stylo-glossus and

stylo-pharyngeus, reaching the pharynx close by the border of the internal pterygoid muscle. After having given small twigs to the tonsil, the styloid muscles, and Eustachian tube, it divides near the side of the levator palati into two ramusculi; of which one follows the course of the circumflexus palati muscle, and ramifies in the soft palate and its glands; whilst the other passes to the tonsil, supplying it, and anastomosing with the following branch.

The tonsillar branch (r. tonsillaris) ascends by the stylo-glossus to the side of the pharynx, and terminates by dividing into several ramusculi, which are distributed to the tonsil and side of the tongue.

The glandular branches (r. glandulares), a fasciculus of small branches, pass into the substance of the submaxillary gland (plate II. No. 19), whilst the artery is in contact with it; some of these are prolonged to the side of the tongue.

The submental branch (r. submentalis, plate V. fig. 1, c) departs from the artery near its turn round the jaw, and runs forwards between the mylo-hyoideus and digastricus, close to the margin of the bone. At the symphysis of the chin it divides (after having previously given offsets to the submaxillary gland and muscles) into two branches, one of which, more superficial than the other, passes between the depressor labii inferioris and the skin, supplying both, whilst the other lies between this muscle and the bone, sending twigs to the substance of the lip, and communicating with the

PLATE X.

The arteries situated at the posterior aspect of the limb are here shown.

Fig. 1. No. 1. Part of the deltoid muscle. 2, 2. The triceps muscle. 3, 3. The biceps muscle. 4. The brachialis anticus. 5. The supinator longus muscle. 6. The extensor carpi radialis longior. 7. The extensor carpi radialis brevior: (these numbers are seen also at the back of the wrist, where they mark the tendons of the same muscles). 8, 8, 8, 8. The common extensor muscle of the fingers, with its tendons. 9, 9. The extensor carpi ulnaris muscle. 10. The anconeus muscle. 11. Part of the flexor carpi ulnaris muscle. 12. The extensor of the metacarpal bone of the thumb. 13, 13. The extensor of its first phalanx. 14. The tendon of the extensor of the second phalanx. 15. The abductor indicis. 16. The abductor of the little finger.

a, a, a. Muscular branches which come forward from the arteria profunda. b, b. The arteria profunda. c, c. Muscular and cutaneous branches from the interosseous recurrent, communicating with the profunda and the radial recurrent. d, d, d. Twigs from the radial recurrent artery. e. A small branch from the superior perforating interosseous artery. f, f, f. Muscular and cutaneous twigs from the lower perforating artery. g, g. Cutaneous branches at the back of the wrist-joint, resting upon the posterior annular ligament. h. The dorsal carpal branch from the ulnar artery. i, i. The radial artery where it runs forwards at the back of the hand, previously to its getting deep, to reach its palmar aspect. k. The dorsal branch, which, with a similar branch (h) from the ulnar artery, forms an anastomosis upon the back of the hand. l. The dorsal digito-ulnar branch of the thumb. m. Its palmar digito-ulnar branch. n. The dorsal digito-radial branch of the fore-finger. o, o, o. Dorsal interosseous arteries. p, p, p, p. Dorsal arteries of the fingers. q, q, q. Small branches given by the palmar digital branches to the back of the fingers.

Fig. 2. shows the anastomosis between the arteries at the back of the elbow-joint.

No. 1. The posterior surface of the humerus. 2. Part of the brachialis anticus muscle. 3. The inner condyle of the humerus. 4. The olecranon process of the ulna. 5. The external condyle. 6. The external lateral ligament. 7. The orbicular ligament of the radius. 8. The radius. 9. The ulna.

a. The superior profunda artery. b. The inferior profunda. c, c. The anastomosing communications between these and the branches coming upwards from the arteries of the fore-arm. d. The posterior ulnar recurrent artery. e. The interosseous artery. f. Its recurrent branch: close beside this is a branch derived from the ulnar artery, and which, after passing through the interosseous space, ascends to join the anastomosis.

Fig. 3. The deep-seated branches of arteries at the posterior aspect of the limb are here shown.

No. 1. Part of the humerus. 2. The brachialis anticus muscle. 3. Part of the long supinator muscle. 4. The insertion of the triceps muscle. 5. The external lateral ligament of the elbow-joint. 6. The head of the radius covered by its orbicular ligament. 7, 7. The interosseous ligament. 8. The ulna. 9. The radius.

a, a. The superior profunda artery. b. The radial recurrent branch. c, c. The anastomosis at the back of the joint. d. The interosseous recurrent branch ascending to join the general anastomosis. e. The superior perforating branch of the interosseous artery. f, f, f. Smaller perforating branches. g. The inferior perforating branch. h, h. Branches descending to join the anastomosis of arteries at the back of the wrist-joint. i, i. The radial artery running forward to reach the cleft between the thumb and fore-finger, where it turns into the palm of the hand. k, k. Its dorsal carpal branch. l. The dorsal digito-radial branch of the thumb. m. The dorsal digito-ulnar branch of the thumb. n. The palmar digito-ulnar branch. o. The dorsal digito-radial branch of the fore-finger. p, p. The dorsal carpal branch of the ulnar artery. q. The dorsal digito-ulnar branch of the little finger. r, r, r. Perforating branches from the palmar arch, coming through the interosseous spaces, and joining the dorsal vessels. s, s, s. The dorsal interosseous branches. t, t, t. Their points of division into the digital branches.

Plate 10.

Fig. 1.

Fig. 2.

Fig. 5.



Fig. 1.

Fig. 2.

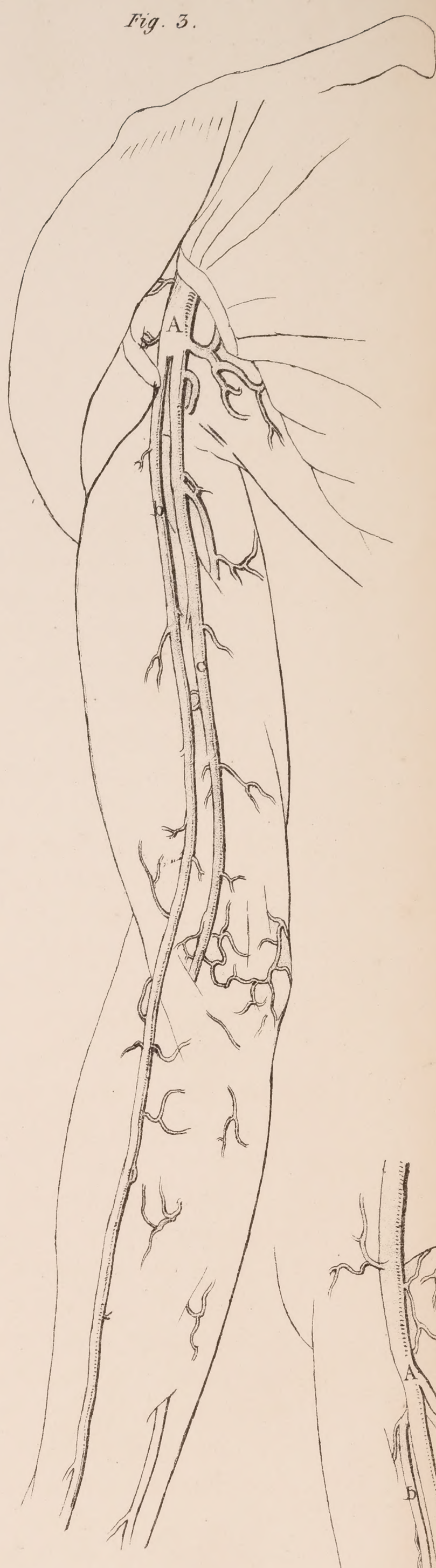


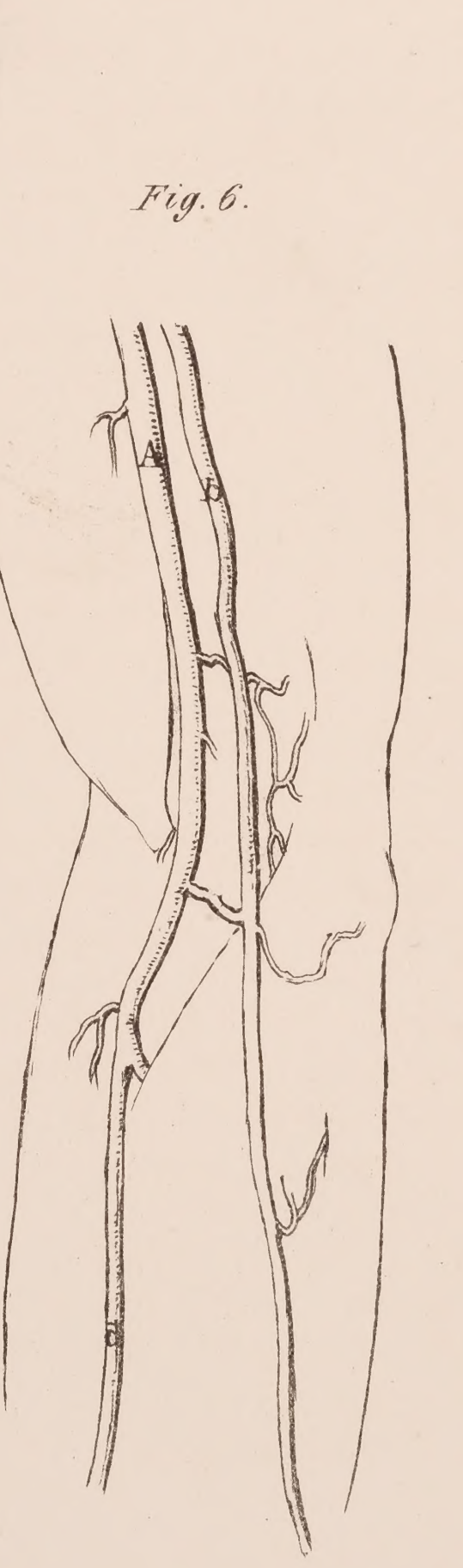
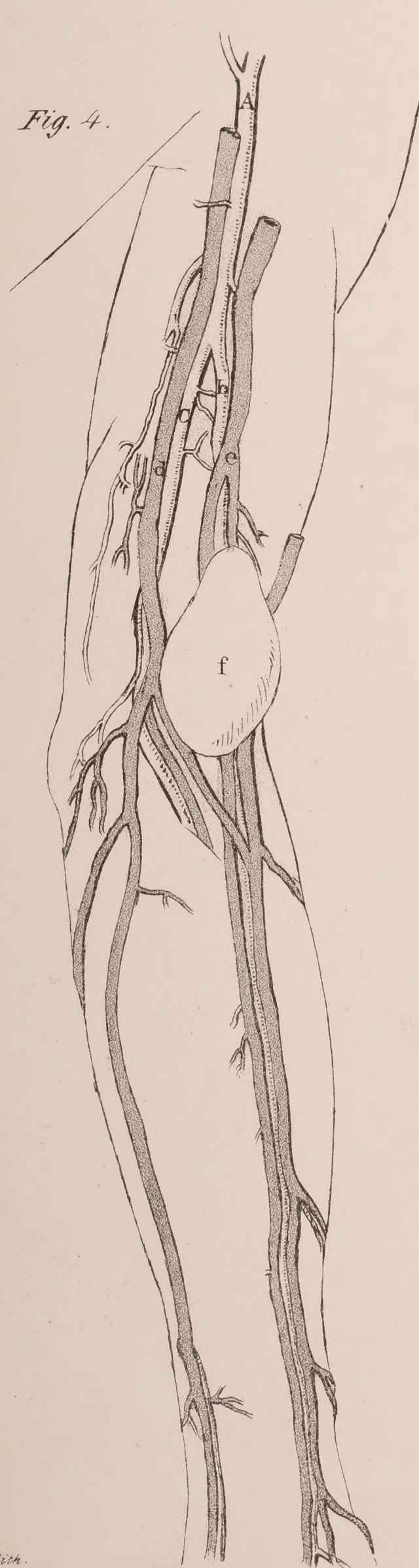
Fig. 5.

Fig. 7.

Fig. 4.

Fig. 6.

Fig. 8.



following branch. The submental artery will sometimes be found of considerable size, and then it gives off the sublingual.

The inferior labial (r. labialis inferior, vel superficialis; plate VI. fig. 2, s) inclines inwards, sending ramusculi to the muscles of the lower lip, and anastomosing with the r. coronarius inferior, with the submental, and the termination of the dental artery.

The coronary artery of the lower lip (r. coronarius labii inferioris; plate VI. fig. 1, g) arises near the angle of the mouth, and takes a transverse and tortuous course upon the mucous membrane, covered by the muscles of the lip, at the middle of which it inosculates with the corresponding artery of the opposite side. Some of its ramusculi are distributed to the orbicular and depressor muscles, others pass downwards to the chin, communicating with the branches that ramify there.

r. Coronarius labii superioris is larger and more tortuous than the preceding, above which it arises, taking a similar course as it proceeds inwards, across the upper lip (plate VI. fig. 1, h). It passes under cover of the zygomaticus and orbicularis, and forms an arch by inosculation with the corresponding artery of the opposite side. In addition to several small twigs to the muscles of the lip, it gives two or three to the nose. One of these (*r. nasalis septi*) proceeds along the septum to the extremity of the nose; the other (*r. nasalis lateralis*) ramifies on the side of the nose, and forms a minute network on its ala, to which the nasal branch of the ophthalmic artery also contributes.

The facial artery is the chief medium of communication between the superficial and deep branches of the external carotid, by means of its anastomoses with the infra-orbital, dental, and nasal branches; also between the external and internal carotids, by its anastomosis with the ophthalmic artery.

The Ascending Pharyngeal artery (a. pharyngea ascendens) lies deeply and concealed from view until some of the branches of the carotid artery and the stylo-pharyngeus muscle are drawn aside. It arises near the lingual artery, or even from the bifurcation of the common carotid, and is the smallest of the branches of the external carotid. It rests on the rectus capitis anticus major, close to the surface of the pharynx, and is directed up as if towards the foramen lacerum posterius. Its branches are necessarily small—they are mere ramusculi. We may, however, from a consideration of their destination, divide them into three sets.

Pharyngeal branches.—These pass inwards to the pharynx. One or two small and variable branches ramify in the middle and inferior constrictors. Higher up than these is a larger and more

PLATE XI.

These sketches are intended to show the varieties in the size and place of origin presented by the branches of the brachial artery. The usual distribution of the vessels is given in the preceding Plates, IX. and X.

Fig. 1. A. The brachial artery taking its usual course. b. The sub-scapular artery. c. The posterior circumflex branch. d. The inferior profunda, or ulnar collateral branch, which is seen to arise from the posterior circumflex branch.

Fig. 2. A. The brachial artery. b. The superior profunda. c. The inferior profunda, or ulnar collateral branch, of large size, arising lower down: this is a very frequent mode of distribution.

Fig. 3. Here the radial artery, b, commences in the axilla from the axillary artery, A, and runs down the arm parallel with the brachial artery, c, which finally terminates in the ulnar artery.—(These three drawings are of the right arm.)

Fig. 4. The brachial artery, A, gives off the radial, b, and the ulnar, c, in the middle of the arm; the basilic vein, d, and the cephalic, e, are in their usual situations. The radial artery was punctured in the operation of bleeding in the cephalic vein, and gave rise to an aneurismal tumour, which is marked f.—(This is the left arm.)

Fig. 5. The ulnar artery arises in the middle of the arm from the brachial artery, A, and runs down superficial to the muscles of the fore-arm, and of the process of tendon, d, given off from the biceps muscle. The radial artery, c, is prolonged from the brachial, taking its usual course.—(This is the left arm.)

Fig. 6. The ulnar artery, b, arises very high up, and runs parallel with the brachial, A, with which it is connected at the bend of the elbow by a transverse connecting branch, c: it moreover runs superficial to the flexor muscles. The radial artery, d, takes its usual course; but it gives off the interosseous branch.

Fig. 7. The interosseous artery, b, is seen to arise from the brachial, A, high up in the arm: at the bend of the elbow it gets under the pronator and superficial flexor muscles, and comes into its ordinary situation in the fore-arm, where its course is indicated by the letters b, b. The ulnar artery in this case ran superficial to the muscles of the fore-arm.

Fig. 8. The radial artery here arises from the brachial above the middle of the arm, and runs down superficial to the tendinous process, g, given off by the biceps muscle: the ulnar artery, c, gives off the interosseous artery, d, in the usual situation; but this vessel is seen to divide immediately after its origin into two branches, of which that marked e, occupies the usual situation of the interosseous artery, whilst the other, f, becomes superficial, and runs in front of the anterior annular ligament of the wrist, after which it ends in the superficial palmar arch of arteries.—(Figs. 6, 7, and 8, represent the right arm.)

regular branch, which runs upon the upper constrictor, and sends delicate ramifications to the Eustachian tube, the soft palate, and the tonsil.

The external branches consist of some small and irregular twigs, which are given to the first cervical ganglion, to some of the cerebral nerves as they issue from the skull, and to the conglobate glands of the neck.

Meningeal branches.—The terminating branches are those which pass through the holes at the base of the skull: one or two of them accompany the internal jugular vein through the foramen lacerum posterius, and ramify in the dura mater. Another passes through the foramen lacerum medium basis cranii, and is similarly disposed of.

The Occipital artery (a. occipitalis, plate IV. f; plate VIII. a) runs a long and tortuous course deeply at the upper part of the neck and base of the skull, and finally arches up towards the vertex, ramifying beneath the pericranium. This vessel passes backwards, from the external carotid, opposite either to the lingual or facial artery, and takes the direction of the posterior belly of the digastricus, to reach the interval between the atlas and mastoid process, where it runs in a groove behind the latter. In this course it crosses the internal carotid artery, the vagus nerve, and jugular vein; the lingual nerve will be observed to hook round it; it is covered in the first place by the sterno-mastoid muscle; then it passes under the trachelo-mastoid, the splenius, and frequently the complexus, and is separated from the occipital bone by the fibres of the obliquus and rectus superior. The artery then changes its direction, and runs upwards, piercing the cranial attachment of the splenius and trapezius, and mounts beneath the integument, freely distributing branches. In its course the following branches are given off:

Muscular branches.—Small twigs to the digastricus and stylo-hyoideus, and some of a larger size to the sterno-mastoideus.

An auricular branch to the back part of the concha of the ear, and two or three to the splenius and trachelo-mastoid.

A long descending branch (ramus princeps cervicis) is of variable size, being in some cases a small branch, and sometimes nearly as large as the continuation of the artery itself. When this is the case, it descends beneath the complexus, towards the lower part of the neck, and anastomoses freely with the r. cervicalis profundus of the subclavian artery. Some branches of this vessel pass outwards to the transverse processes of the vertebræ, communicating with the r. cervicalis ascendens and the external ramifications of the vertebral artery.

A Meningeal branch runs up with the internal jugular vein, enters the skull through the foramen lacerum posterius, and ramifies in the dura mater investing the cerebellum.

The *superficial* or cranial branches of the occipital artery pursue rather a tortuous course, and as they proceed forwards on the skull separate into three divisions, which ramify upon it; these communicate with the branches of the corresponding artery of the opposite side on the one hand, with those of the posterior auris on the other, and with the temporal artery in front. Some of these are given to the fleshy fibres of the occipitalis muscle, others to the skin, and one (*r. mastoideus*) enters the mastoid foramen, and ramifies in the dura mater.

Posterior Auricular artery (plate IV. g).—This is a small vessel, (a. auricularis posterior,) which arises sometimes from the occipital artery, but in most instances from the carotid, a little higher up than the latter. It ascends, under cover of the parotid gland, in the direction of the fold or angle formed by the cartilage of the ear with the side of the head, and finally, after having passed above the mastoid portion of the temporal bone, it divides into two sets of ramusculi, of which one inclines forwards to anastomose with the ramifications of the temporal artery, the other backwards to communicate with the occipital. In its course the following branches are given off:

Some small twigs to the parotid gland and digastricus.

A Stylo-mastoid branch enters the foramen of that name, and, on reaching the tympanum, divides into delicate ramusculi, which pass, some to the mastoid cells, others to the labyrinth. One branch will constantly be found, in young subjects, to form, by uniting with a twig that enters the fissura Glasseri, a sort of coronary artery round the osseous ring of the meatus auditorius, from which delicate offsets pass inwards, upon the membrana tympani. This sometimes arises from the occipital artery.

One or two branches ramify on the posterior surface of the concha.

Opposite the neck of the condyle of the lower jaw, the external carotid artery divides into two terminating branches, one being superficial, the other deeply seated.

The Temporal artery (a. temporalis, plate VI. fig. 2, C, C) is at first imbedded in the substance of the parotid gland, where it lies in the interval between the tube of the ear and the condyle of the lower jaw. It soon turns forwards to reach the cutaneous surface of the zygoma, on which it may be

readily compressed, being merely covered by the integument, the prolonged part of the cervical fascia, and the thin tendon of the attrahens aurem muscle. Continuing to ascend, the artery lies beneath the skin, supported by the temporal muscle and its fascia, and divides into two sets of arching branches, which ramify beneath the integument. In its course it gives off:

Some small twigs to the parotid gland.

One or two to the masseter muscle (*massesterici*).

Ramus transversalis faciei (plate VI. fig. 1, d) arises whilst the artery is deeply seated, and inclines upwards and forwards through the substance of the parotid gland, so as to get between its duct and the zygoma, resting on the masseter muscle, and accompanied by one or two transverse branches of the facial nerve. It sometimes gives off some masseteric branches, and divides into three or four ramusculi, which are distributed to the side of the face, anastomosing with the infra-orbital and facial arteries.

A *middle temporal branch* dips beneath the temporal fascia, and inclines forwards between it and the muscle of the same name, sending branches into the latter, which communicate with the deep temporal branches, whilst others extend to the external angle of the orbit, where they meet some ramifications of the ramus lachrymalis. Soon after its origin, this vessel usually gives some twigs to the meatus externus of the ear (*r. auriculares anteriores*).

The *Anterior temporal branches* (plate VI. fig. 1, b, b) incline forwards as they ascend, and ramify extensively over the forehead, supplying the orbicularis and occipito-frontalis muscles, and communicating with the frontal branches of the ophthalmic artery.

The *Posterior temporal branch* inclines back on the side of the head, and seems to be the continuation of the original vessel; its branches ramify freely, both upwards to the vertex, where they communicate with those of the corresponding vessel of the opposite side, and backwards, to meet those of the occipital artery.

Internal maxillary artery (plate VI. fig. 2, B, B).—This vessel (a. maxillaris interna) is larger than the temporal, and follows a serpentine and complex course from its commencement to its termination, changing its direction several times. On leaving the external carotid it inclines downwards and inwards, so as to get under cover of the ramus of the jaw, and, in the next place, proceeds inwards, between the two pterygoid muscles. Opposite the pterygoid process it ascends perpendicularly, passing between the two heads of the pterygoideus externus, and thus reaches the spheno-maxillary fossa, where it makes its final turn, forwards and inwards, becoming horizontal. Having assumed this direction, the artery, considerably diminished in size by having given off many branches, passes directly forwards beneath the orbit lodged in the infra-orbital canal, and finally emerges on the face, where it terminates by several small ramusculi. It will thus be observed, that the artery in its course is successively in relation with the ramus of the jaw, the pterygoid muscles, the spheno-maxillary fossa, and the floor of the orbit. As at each of these stages of its progress it gives off branches, we may divide them into four sets, corresponding with the points above referred to.

1. Branches of the internal maxillary artery given off near the ramus of the jaw.

Ramus tympanicus passes deeply behind the articulation of the lower jaw, and enters the fissura Glasseri, supplying the laxator tympani, and ramifying in the cavity of that name, as well as on its membrane.

r. Meningeus parvus sometimes arises from the succeeding branch, or from one of those given to the pterygoid muscles. It ascends between the pterygoid plate and the circumflexus palati, and enters the skull through the foramen ovale, to supply the dura mater.

r. Meningeus medius, vel magnus, (plate VI. fig. 2, 1*, 1*) is by far the largest of the branches given to the dura mater. It passes directly upwards to the foramen spinale in the sphenoid bone, which transmits it to the interior of the skull, where it will be observed to run in a groove marked on the great wing of the sphenoid bone, the squamous part of the temporal, and the inferior angle of the parietal. From the last point it branches out, its ramifications corresponding with the arborescent lines traced on the cranial bones, but intimately connected with the dura mater; so that, if the latter be detached from the skull, the artery and its branches will be carried with it. (Plate VI. fig. 2, 1*, 1*.)

r. Maxillaris inferior, vel dentalis, (plate VI. fig. 2, f,) enters the dental canal, accompanied by the nerve of the same name, and runs from behind forwards to the foramen mentale, through which it escapes on the face. In its course, the vessel lies beneath the roots of the teeth, and gives off at intervals small twigs, which ascend and enter the minute apertures in their points, and finally ramify in the pulp of each tooth. Near the foramen mentale a branch passes forwards beneath the incisor teeth, which it supplies, and inosculates, at the symphysis of the chin, with a corresponding artery from the opposite side. Its terminal branches on the face anastomose with the coronary and submental arteries.

2. Branches given off whilst the artery is between the pterygoid muscles :

r. Temporales profundæ are two or three branches which ascend between the temporal muscle and the cranial bones, along which they ramify, freely supplying that muscle. (Plate VI. fig. 2, k, i.)

r. Pterygoidei : some small and short ramusculi pass to the pterygoid muscles, which they supply.

r. Massetericus is a small but regular branch which passes from within outwards through the sigmoid notch in the lower jaw, and is distributed to the masseter muscle.

3. The branches given by the internal maxillary artery whilst opposite the pterygo-maxillary fissure:

r. Buccalis passes obliquely forwards upon the buccinator muscle, to which, and to the other muscles of the cheek, it distributes twigs, and anastomoses with the facial artery. (Plate VI. fig. 2, g.)

r. Alveolaris vel dentalis superior turns forwards on the border of the superior maxillary bone, and gives off several small twigs, some of which pierce the bone, and reach the antrum maxillare, where they ramify freely, whilst others penetrate to the alveoli by similar foramina, and enter the roots of the upper teeth to supply their lining membrane. (Plate VI. fig. 2, h.)

r. Infra-orbitalis turns horizontally forwards from the artery when it has reached the sphenomaxillary fossa, and enters the infra-orbital canal, when it sends some twigs into the orbit to supply the inferior oblique muscle and the lachrymal gland. It emerges on the face after having traversed the canal, and sends twigs upwards and inwards to the lachrymal sac and angle of the orbit, which communicate with the *r. nasalis lateralis*, whilst others descend, covered by the elevator of the lip, and anastomose with the transversalis faciei and buccal branches.

4. The branches given off in the sphenomaxillary fossa :

r. Palatinus superior vel descendens is one of the three branches into which the artery may be said

PLATE XII.

The sketches indicate the principal varieties which occur in the arteries of the fore-arm and hand.

Fig. 1. The radial and ulnar arteries, b, c, occupy their usual positions in the fore-arm. Between them is seen a superficial interosseous branch, a, taking the course of the median nerve. It passes, however, superficial to the annular ligament, and terminates by giving branches to the thumb, the fore-finger, and the middle-finger. The ulnar artery in the palm runs obliquely forwards, instead of making its usual curve, and gives branches to the little-finger, the ring-finger, and one side of the middle-finger.—(This is the left arm.)

Fig. 2. The radial artery, a, inclines backward in the middle of the fore-arm, and passes superficial to the supinator longus, extensores carpi, and two extensors of the thumb, as well as the posterior annular ligament, instead of passing under them. The superficialis volæ branch, b, occupies the usual position of the radial at the lower part of the fore-arm, and, on reaching the base of the thumb, gives off its first dorsal collateral branch.

Fig. 3. The ulnar artery, a, runs superficial to the muscles of the fore-arm; the radial artery, b, gives off the interosseous, c.—(Figs. 2 and 3 are of the right arm.)

Fig. 4. The superficialis volæ branch, b, derived from the radial artery, a, is small, and ramifies merely in the muscles of the thumb, without reaching the palmar arch. The ulnar artery, c, forms by itself the superficial palmar arch, and supplies branches to both sides of the fingers, and also to the thumb.

Fig. 5. The superficialis volæ branch, b, derived from the radial artery, a, is unusually large, so that it forms by joining with the palmar part of the ulnar artery, c, about half the superficial palmar arch, having previously given branches to both sides of the thumb, and to one side of the fore-finger.

Fig. 6. The distribution of the arteries in this case is in every particular similar to that in fig. 4, except that the radio-digital branch of the fore-finger is derived from the radial artery.

Fig. 7. The ulnar artery, c, in this case, instead of forming an arch, inclines obliquely across the palm of the hand. The superficialis volæ branch, b, is large, and gives branches to the thumb and to one side of the fore-finger. There is a connexion between this vessel and the ulnar artery by a transverse slip, d.

Fig. 8. The superficialis volæ branch, b, from the radial artery, a, is very small, and ceases amongst the muscles of the thumb. The ulnar artery, c, after forming the palmar arch, communicates by a small twig, d, with the palmar digito-radial branch derived from the radial artery.

Fig. 9. The superficialis volæ branch, b, derived from the radial artery, a, is very large, and supplies branches to the thumb, the fore-finger, and one side of the middle-finger. The ulnar artery, c, waving and tortuous in the palm, gives branches only to the little-finger, the ring-finger, and one side of the middle-finger. There is no branch of connexion between these vessels.

Fig. 10. The anterior digital branches are here seen to come from the deep palmar arch. The radial artery, a, after giving off its superficialis volæ branch, turns into the palm, and forms its deep arch, c: it gives off a digital branch, which divides for the supply of the fore-finger and middle-finger; then one for the latter and the ring-finger; and finally another, which, after receiving a small twig from the ulnar, is given to the contiguous margins of the ring and little fingers. The ulnar artery, d, gives but one digital branch, e.

Fig. 11. The only variation here deserving notice is in the branch, a, which is derived from the superficial palmar arch, and gives communicating branches to the digito-radial of the fore-finger, and both digital branches of the thumb.—(Figs. 4, 6, 7, 8, 9, and 11, are of the right hand. Figs. 5 and 10 are of the left.)

Fig. 2.

Fig. 3.



Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

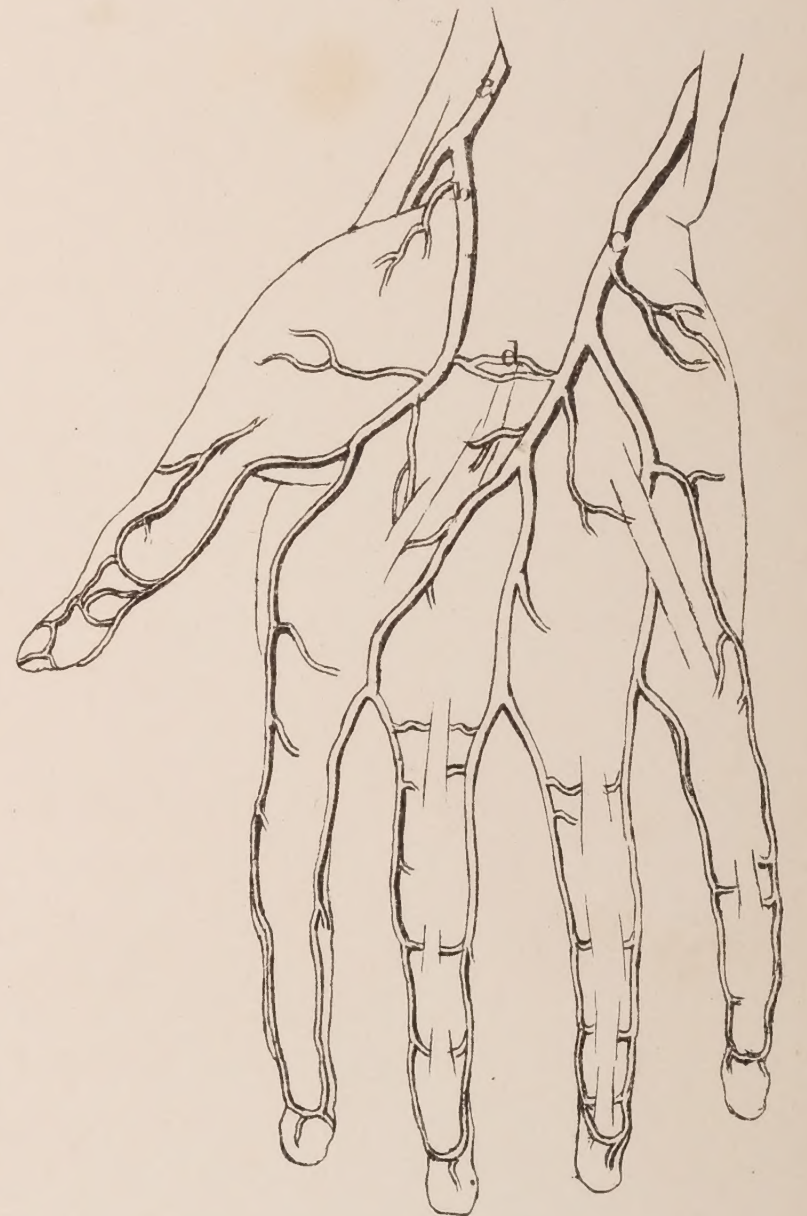
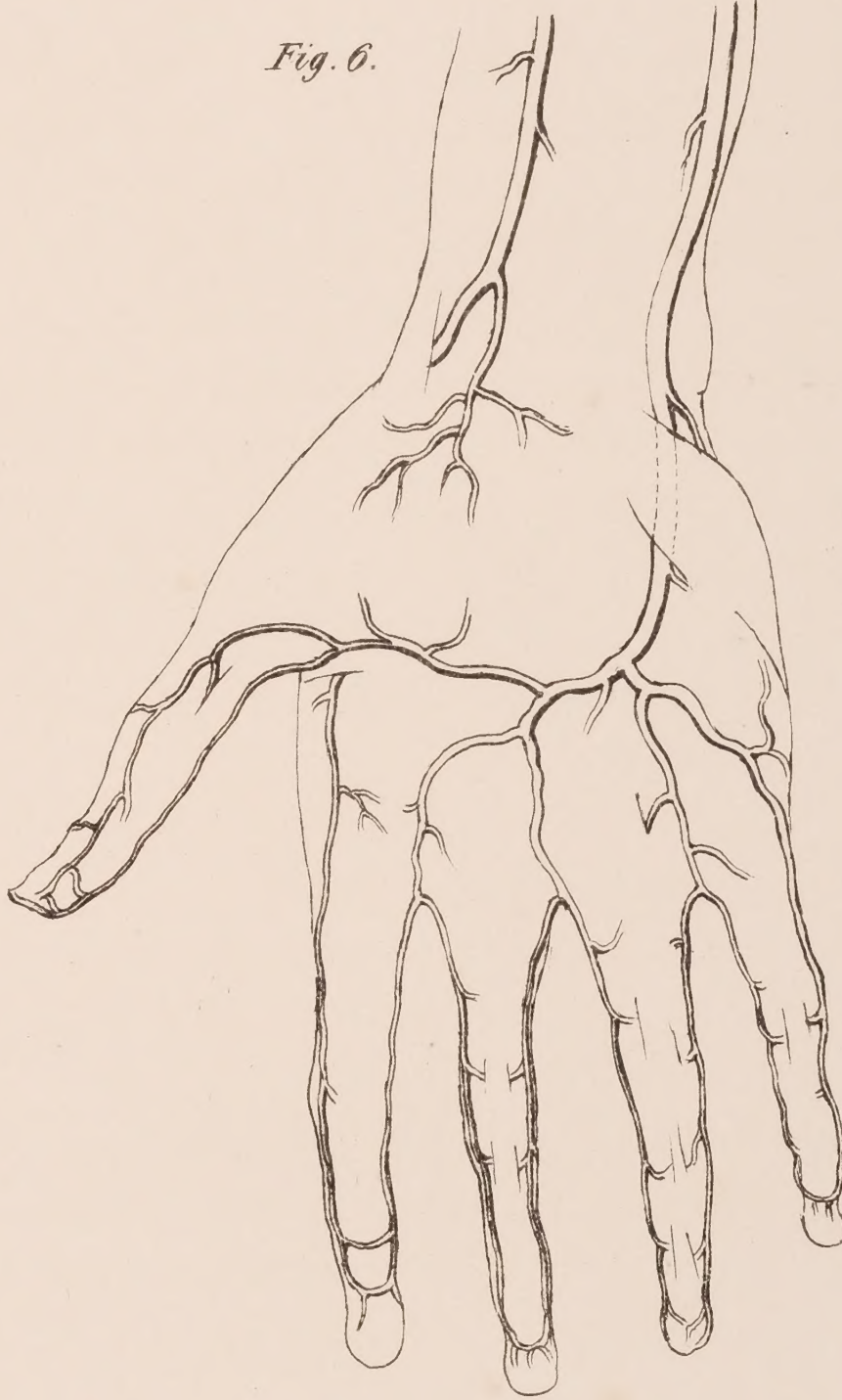
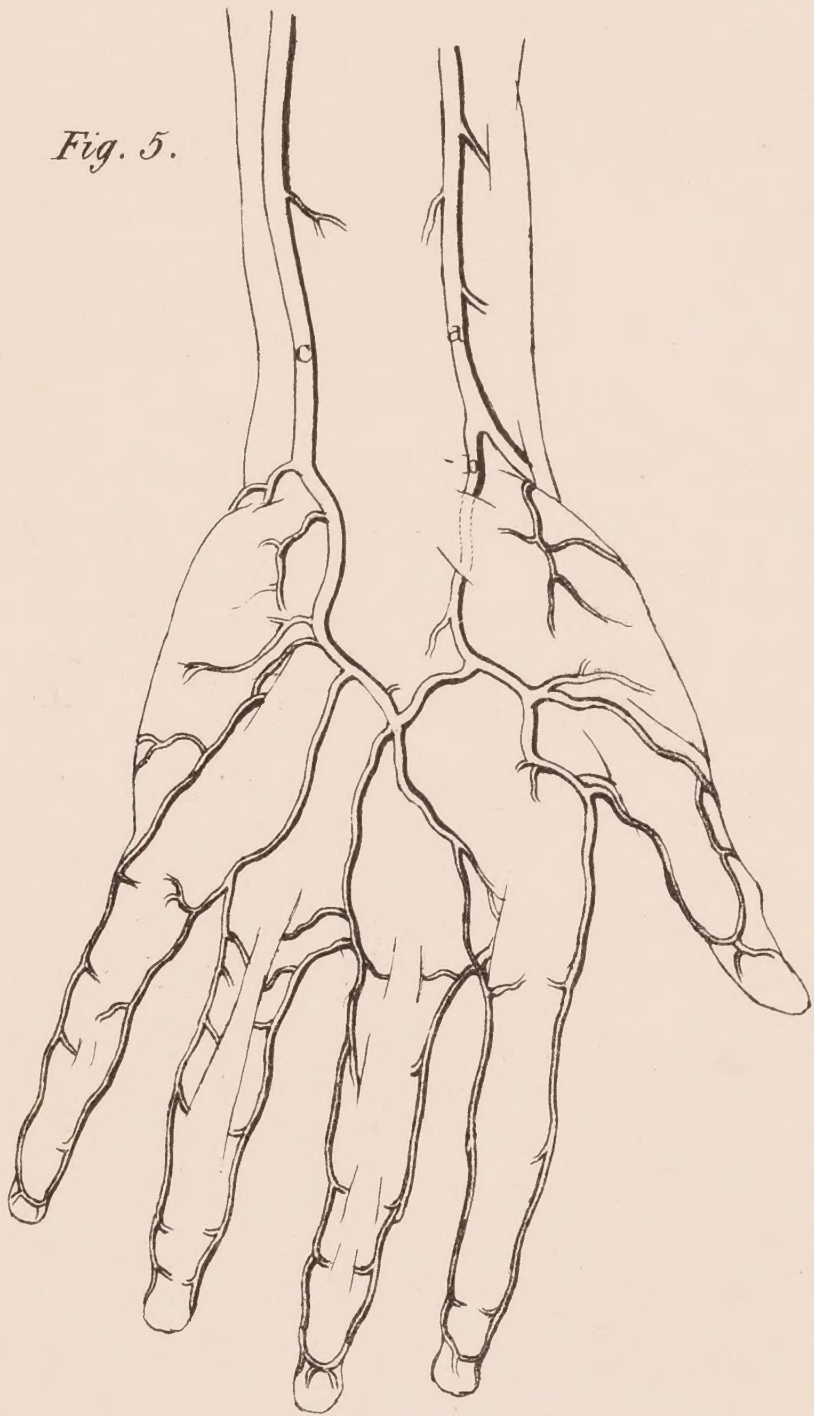
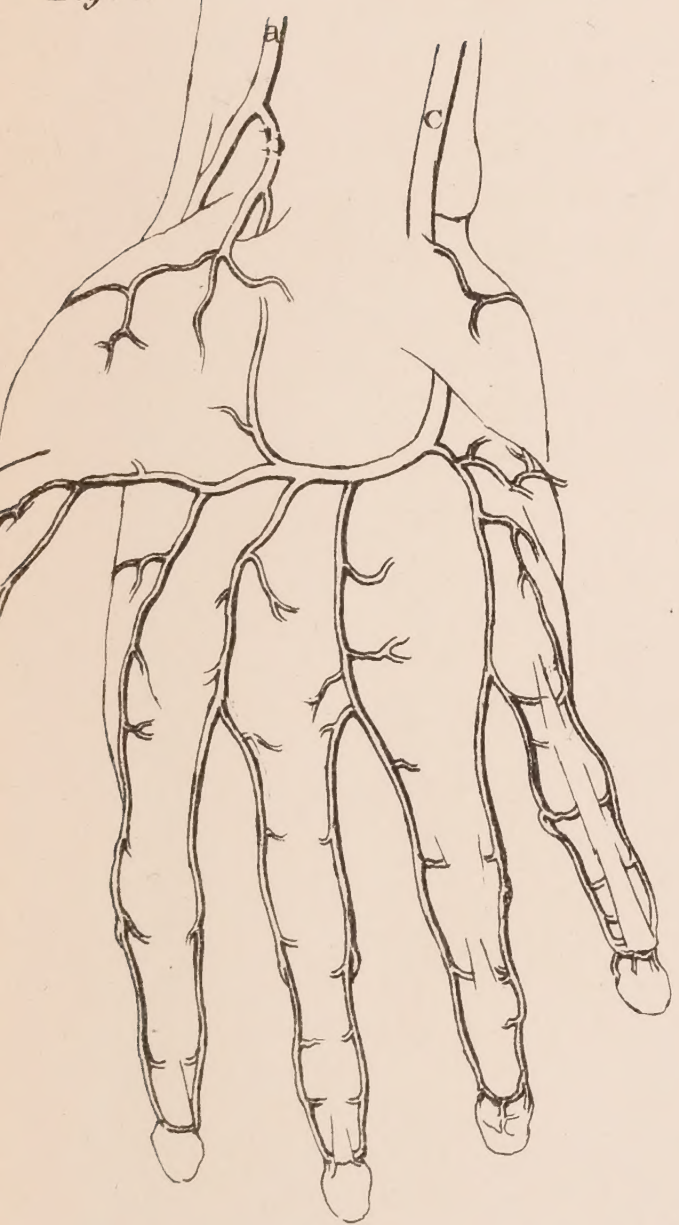
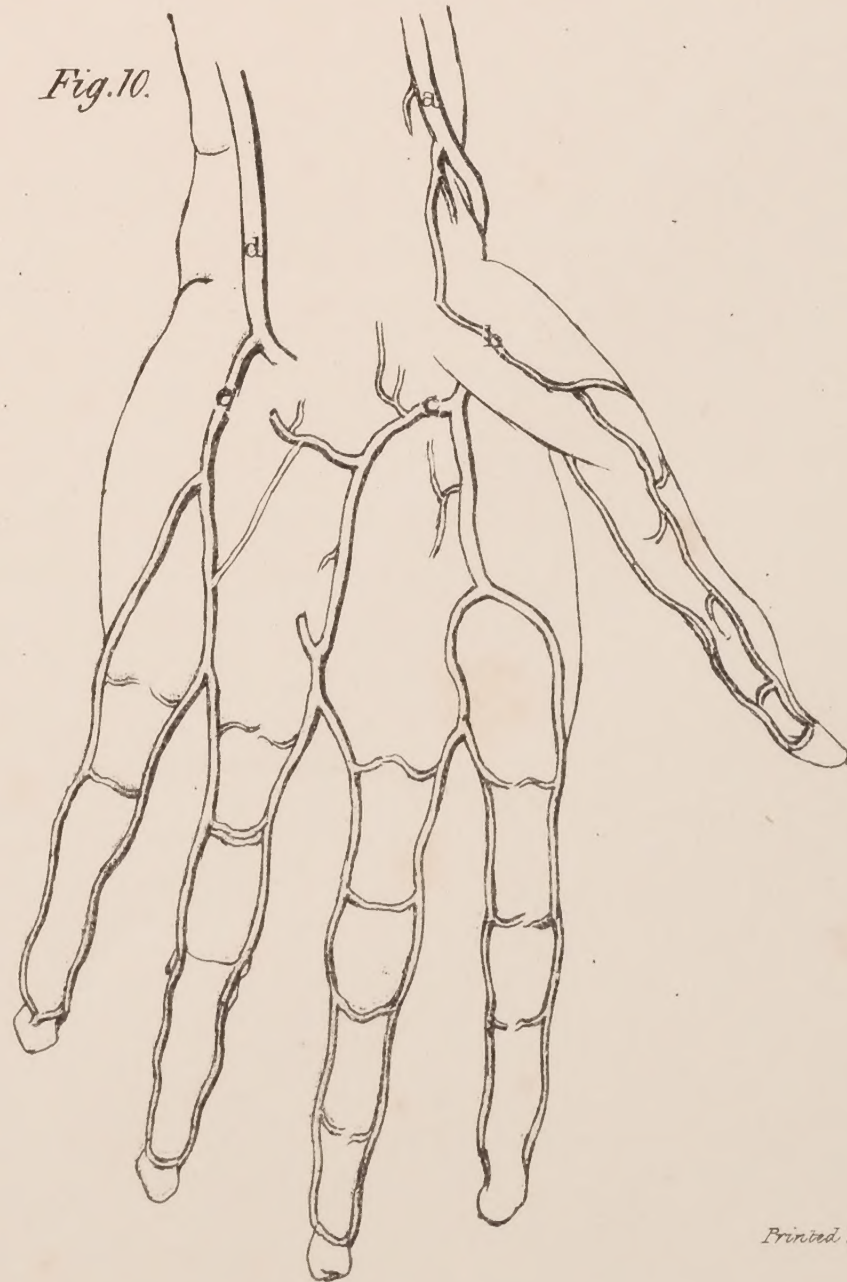
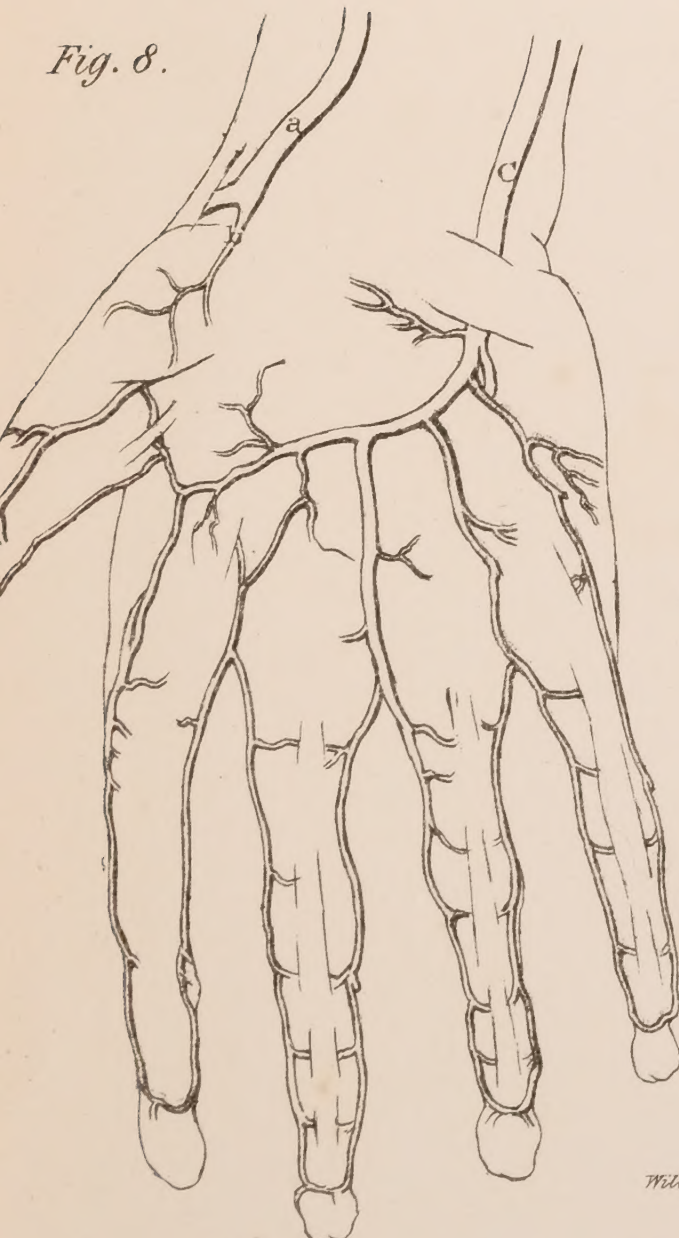


Fig. 8.

Fig. 9.

Fig. 10.

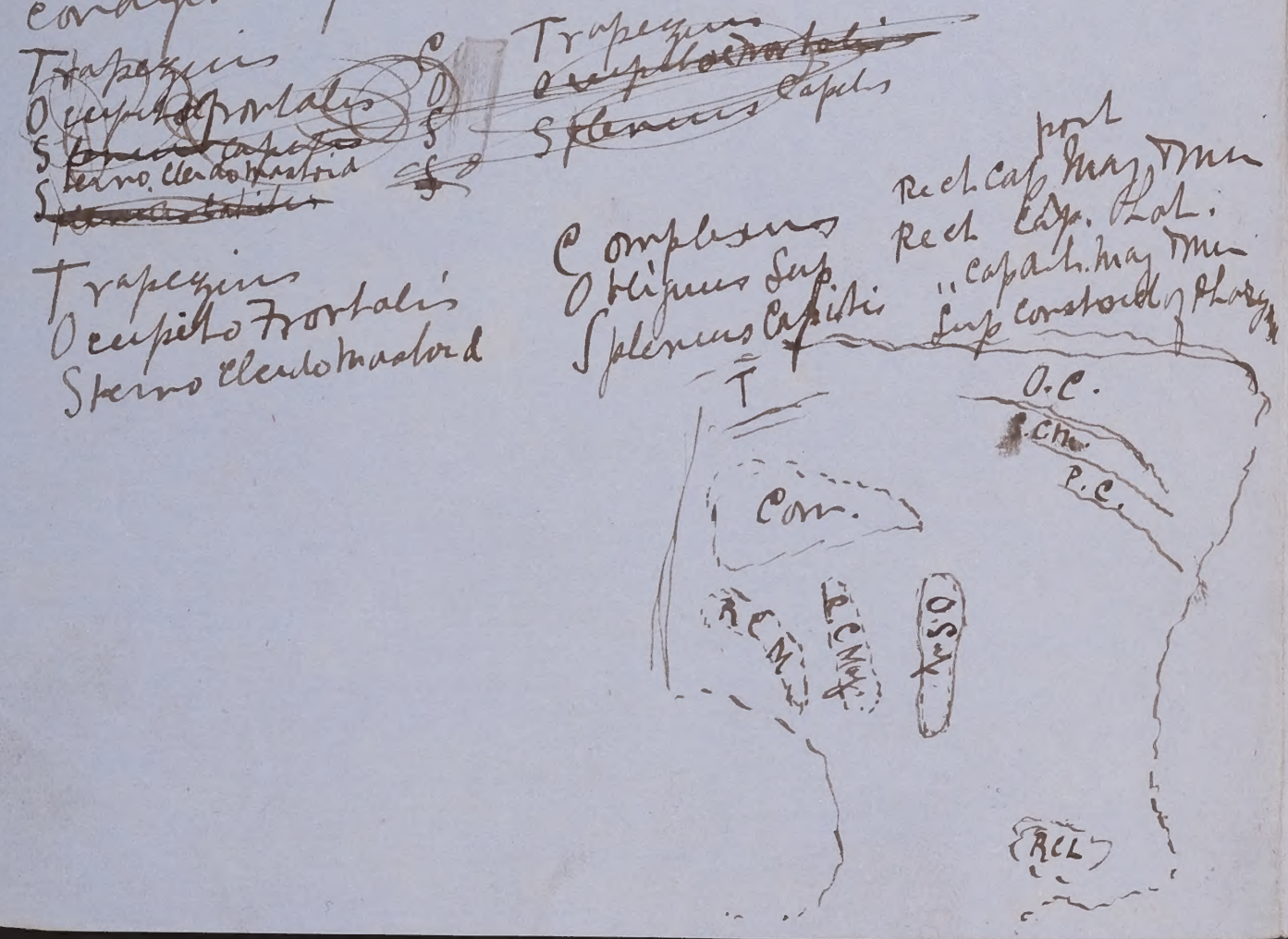
Fig. 11.



William Fairland del. et lith.

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On cerebral surface, we observe 2 thick ridges of bone. one vertical, 1 horizon. which cross each other. both more or less covered for sinuses, the vert. contains sup. long sinus above & occipital below. which generally subdivides into 2 smaller, the horizon contains ft. lat. sinus. Ridges give attachment to dura mater. Crossing point is called Int. Sec. For tubercle, where for sinuses meet. These ridges divide bone into 4 fossae. for post. lobes of cerebrum & above cerebellum below. Articulates with 6, 2 Parietal, 2 Temporal, Sphenoid, & Atlas. Development, 4 centres. 1 for Basal process. 1 for occipital portion 1 for each condyloid portion.

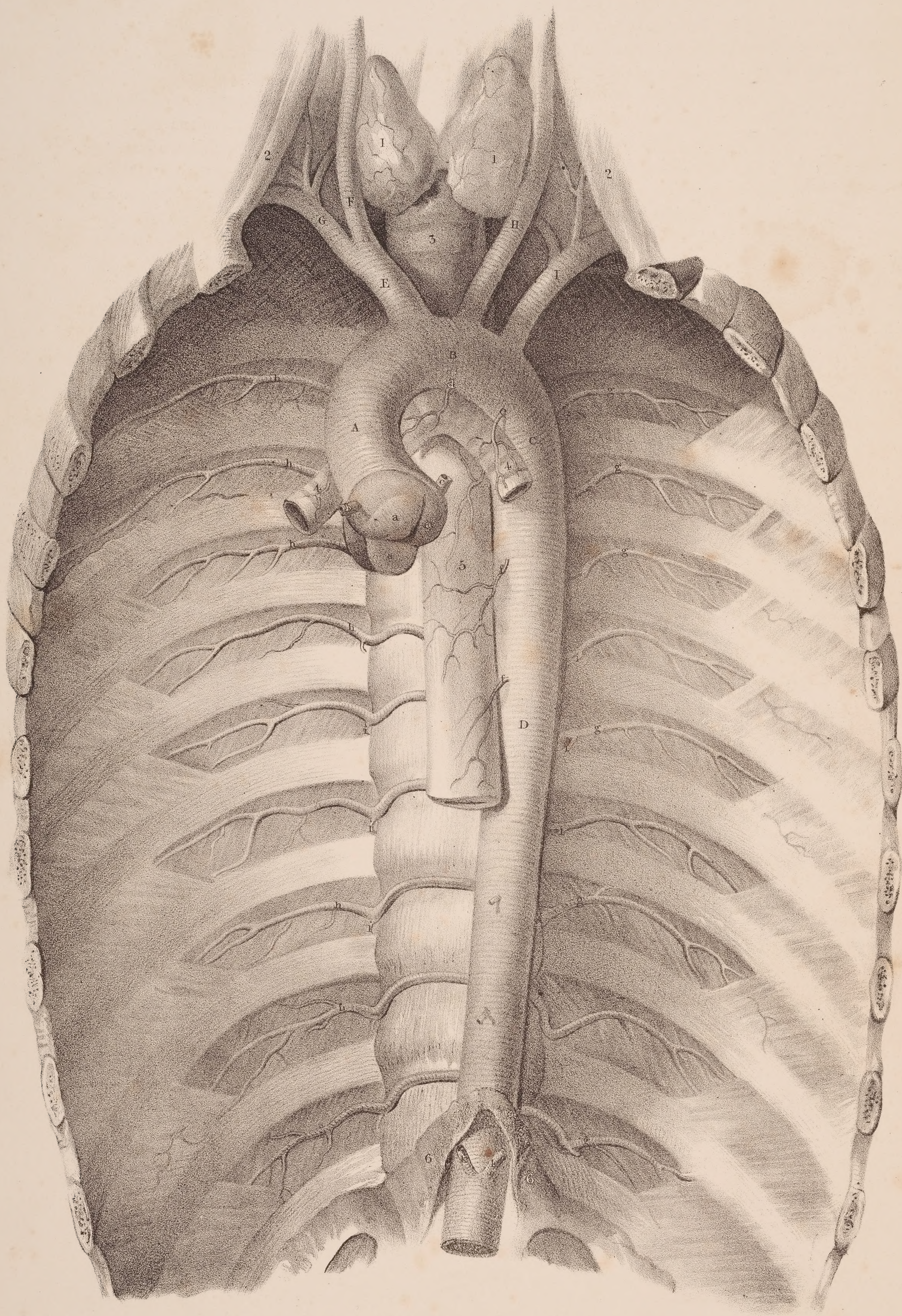


Temporal Bone: 3. Petrous, Squamous, Petrous & Mastoid, which represent permanent & distinct bones in lower animals. Squamous, very thin, internal surface marked by convolution of grain narrow groove for md. men. artery from before backwards. Zygoma projects horizontally forward base broad, springs from 2 roots. art. post. in interval between which is a glenoid cavity - socket for lower jaw, post. root runs backwards, in line with zygoma & forms upper boundary of glenoid cavity. Art. not. main art. is very broad & short, runs trans. inwards to form part boundary of cavity, is called Emervertia articularis, is covered with cart. in recent state. When mouth is wide open cartilage plays upon Emervertia articularis. Tubercle on base of zygoma for lat. col. of lower jaw. glenoid cavity, oval concave pointing backwards, long dia. trans. at bottom glenoid fissure, the part in front of fissure is for proper socket for lower jaw, part behind is occupied by a lobe of parotid; fissure leads to tympanic fissure contains processus gracilis of malleus (Post glenoid process) Tympanic artery. laxator tympani & is usually said to transmit, Chorda tympani nerve which strictly speaking runs through canal of trigem. close to fissure. Mastoid for. cells, communicate with tympanum, & contain warm air which is admitted from back of nostrils through Gustacheal tube, useful in hearing by allowing more air space for vibration of air. Stenosis to Mastoid for. is digestive for. for digestive & the hind process is the posterior for. on cerebral aspect is groove for lat. sinus. Petrous Portion, 3 surfaces, base & apex. Mentes and. lat. bounded by curved plate of bone called processus in disjunctus, Mentes is oval with long diameter vly vertical narrowest part is about middle

Ant surface of Petrous presents 1 eminent indirectly
position of some circular canals. 2 Hiatus Fallopii
for vagus immediately borderside furrow canal
for lesser petrosal nerve. 3 depression for
passerine fangion. 4 termination of Carotid
Canal. 5 Canal for tensor tympani muscle.
6 Gustachian tube separated by processum
cochleariformis. Post surface. 1 Meatus
auditorius int. 2 aqueductus vestibuli 3 aqueductus
cochlear. Inf surface. 1 Styloid process for stylopharyngeus
- hyoidus - glossus. 2 tip of stylo-hyoid lig. 3 stylo maxillary
2 Vagral process. 3 Stylo mastoid foramen
transmits 7th & a small artery - stylo mastoid
to supply tympanum & Jugular fossa. 5 Minute
for. for Arnold's nerve. 6 Carotid Canal. 7.
Minute for. for Jacobson's nerve on plate of bone
which separates Inf. fossa. Carotid canal.
8 rough surface. for tensor tympani.
levator palati. Along sup. border
is groove for sup. petrosal sinus
Articulations, 5 Parietal, Spheroid.
occipital, mastoid, Inf Maxillary.
development. 4 centres. 1 for squamous & zygoma
1 petrous & mastoid 1 tympanic or process
auditorius. 1 styloid process.

Occipital Bone. Foramen Mag. & Basilar process.
For mag large & oval. very much larger than parts
which pass through it, space being occupied
by cerebrospinal fluid. Basilar process ends
protr. with larynx pharynx. it is within reach of
finger. joined to sphenoid with cartilage, which in
adult becomes ossified. A tubercle in middle line
for prominence of pharynx. Laterally rough
surface for Rectus. Cap. Ant. Mag. & Min.
On upper surface a partly oblique groove
for Med. ob. a thin layer of fibrous integ.
posed. On either side a smaller groove for
of Petrous Sinus. Occipital protuber.
crest leading to For Mag. from which crest
runs outwards Sup. & Inf. curved line
condyles on either side of for mag, on its ant. half.
oblong & convex with ant. ends converging.
inner margin lower. ~~odontoid~~ or Tubercle
for check or odontoid lig. Ant. Condyle for
for mouth (outwards & forwards.)
Emunera innominata, emergence of bone
in front of Ant. Condyle for. ~~Post. Condyle for~~ Fossa
at bottom of which is foramen of same name
which is the opening of canal which runs
horiz. forwards into proozygous lat sinus
Jugular eminence, on under surface rough
Rect. Cap. lat. On its upper surface deep groove
for lat. sinus, it turns suddenly downwards to form
Inf. fossa, which lodges commencement of Inf. jug. vein & with
Petrous contributes to form post. fossa.

Plate 13.



J. Walsh del.

William Bayland lith.

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London, John Taylor, Upper Gower St.

to divide at the point just indicated. It passes perpendicularly downwards through the posterior palatine canal, and so reaches the arch of the palate, along which it ramifies, supplying the gums and soft palate, and anastomosing with the nasal artery by a branch sent up through the foramen incisivum. At its point of origin a reflected branch passes directly backward to enter the Vidian canal with the nerve of the same name. Hence it is termed the *Vidian*, or pterygoid branch. It is distributed to the Eustachian tube and top of the pharynx.

r. Pterygo-palatinus is a very small ramusculus, which passes backwards and upwards to reach the pterygo-palatine foramen, by which it reaches the top of the pharynx, where it freely ramifies, after having given some twigs to the Eustachian tube and sphenoidal cells.

r. Nasalis vel spheno-palatinus artery enters the foramen of that name, by which it reaches the cavity of the nose at the posterior part of the superior meatus. There, lying between the mucous membrane and the bone, it divides into two or three ramusculi; one of these ramifies on the septum narium, the others on the spongy bones, some twigs being sent into the posterior ethmoidal cells as well as the antrum.

The vessels here described as arising from the external carotid, present several varieties in their mode of origin in different instances, and some also as to the relative size of the branches which two or more of them send to the same parts. If the supply from one quarter be greater than usual, that from another will be proportionally diminished, by the operation of a principle of compensation so constantly observable in the distribution of vessels. These arteries are not merely branches issuing from a common trunk, for, if viewed in a general way, it will be found that each of them is intended for a particular organ or system of organs, and therefore should be treated as a trunk in itself, or a special source of supply to the parts to which it is distributed. Thus, the vocal and part of the respiratory apparatus are supplied by the superior thyroid artery ramifying on the exterior, as well as in the interior of the larynx. The upper part of the digestive tube derives its blood from the lingual, the palatine, and pharyngeal arteries. The face, including the organs of expression and mastication, receives supplies from several vessels, the facial and internal maxillary arteries being the chief, whilst the occipital and temporal ramify on the cranium. This arrangement was first suggested by Bichât, and is one of the many instances which may be cited of his constant anxiety to make physiology the basis of his classifications.

Varieties.—The bifurcation of the common carotid artery may take place lower down or higher up than the margin of the thyroid cartilage. Burns recites a case in which it occurred as low as the fifth or sixth cervical vertebra; and Meckel mentions one in which its division was opposite the styloid process, and another in which the deviation went still farther, no bifurcation having taken place, for the common trunk gave off those branches to the external parts which usually issue from the external carotid, and then continued its course, assuming the direction and destination of the internal carotid.

Varieties frequently occur in the branches of the external carotid. The superior thyroid artery may arise by a branch common to it and the lingual, or may come from the common carotid at its bifurcation. One or two cases have been cited in which it did not exist, at least at one side, its place being supplied by the inferior thyroid.

PLATE XIII.

The curved part (the arch—*arcus aortæ*), and the straight part of the aorta, are here shown. The thoracic part of the spine, with part of the ribs and intercostal muscles, remain; all the viscera, with the sternum and anterior extremities of the ribs, having been removed.

Nos. 1, 1. The lateral lobes of the thyroid gland. 2, 2. Part of the anterior scaleni muscles. 3. The trachea. 4, 4. The bronchial tubes passing off from the trachea to the lungs. 5. The œsophagus. 6, 6. A few fibres of the diaphragm arching over the aorta as it passes into the abdomen.

A. The ascending part of the arch of the aorta. B. Its transverse part. C. The descending part. D. The straight part, commonly called the thoracic aorta, though that phrase applies to the arched part as well as to this. E. The brachio-cephalic or innominate artery. F. The right carotid artery. G. The right subclavian. H. The left carotid artery. I. The left subclavian artery.

a, a, a. The three semi-lunar valves placed at the commencement of the aorta. b. The right coronary artery. c. The left coronary artery. d, e. The bronchial arteries. f, f. The œsophageal arteries. g, g, g. The intercostal arteries of the left side. h, h, h. The intercostal arteries of the right side. i, i, i. The dorsal or posterior branches given off at each side by the intercostal arteries. k, k. The phrenic arteries arising below the diaphragm from the aorta in the abdomen.

ARTERIES.

H

The lingual artery may arise conjointly with the superior thyroid, but much more frequently with the facial. In the facial artery two varieties very frequently occur, not only in different individuals, but even at opposite sides of the same subject. It has been found very small in some cases, not extending beyond the jaw; but, as if to supply its place, the masseteric and transverse facial branches were unusually large.

The auricular may arise from the occipital, and the latter has in some cases come from the internal carotid.

Operations.—The *common carotid artery* may be exposed and tied in the upper part of its course, viz. after it has passed the omo-hyoideus, by proceeding in this way:—The chin being turned to the opposite side, and pushed upwards so as to extend the parts, an incision may be made along the inner border of the sterno-mastoideus, beginning on a level with the cricoid cartilage, and extending upwards for two inches and a half towards the angle of the jaw. The skin being divided, the platysma is to be cut through to the same extent, and afterwards the cervical fascia; in doing which, a portion of the membrane should be pinched up by the forceps, and cut across, so as to make a small opening for the introduction of a director, on which it is to be slit up. This will expose the sheath of the vessels, which may be opened with the same precaution, care being taken to avoid the descendens noni nerve. When passing the ligature, it will be found convenient to pinch up the inner margin of the divided sheath with the forceps, and draw it forwards. The point of the needle may then be applied closely to the outer side of the artery, by which means the vagus nerve and jugular vein are excluded, and the instrument will be made to slide smoothly between the artery and its sheath.

When proceeding to expose the artery in the lower part of the neck, the incision through the integument should commence on a level with the cricoid cartilage, and extend for fully three inches down towards the sterno-clavicular articulation, along the inner margin of the sterno-mastoid muscle. The skin, platysma, and fascia, being successively divided, the head must be slightly elevated in order to relax the muscles and allow of their being drawn aside. The sterno-mastoid is drawn to the outside, and the sterno-hyoid and sterno-thyroid to the inner side of the wound. Some fibres of the latter may require to be divided in order to bring the sheath of the vessels fully into view. When this is effected, the subsequent steps are the same as in the higher operation.

The *Internal Carotid artery* (plate IV. C; a. carotis interna) commences at the division of the common carotid, opposite the upper border of the thyroid cartilage, from which point it inclines at first somewhat backwards and outwards, but soon turns forwards and inwards, and ascends to the base of the skull to reach the carotid foramen in the temporal bone. In this course the artery is accompanied by the internal jugular vein, which lies external to it, and by the vagus and sympathetic nerves, to which it is closely united by cellular tissue. The hypo-glossal nerve at first lies behind the artery; but as it descends it inclines to its outer side, and finally passes in front of it as well as of the external carotid artery. The artery is supported by the rectus anticus muscle, and is crossed by the digastricus and stylo-hyoideus muscles, and the lingual nerve. Higher up, the stylo-pharyngeus and stylo-glossus, together with the glosso-pharyngeal nerve, pass also in front of it, interposed between it and the external carotid artery. On reaching the lower margin of the canal appropriated to it in the pars petrosa of the temporal bone, the internal carotid artery ascends perpendicularly a little way, and then inclines forwards and inwards, its direction being influenced by that of the osseous tube which encloses it. It soon, however, ascends somewhat to reach the posterior clinoid process, close by which it pierces the deep lamella of the dura mater, which forms the cavernous sinus, but does not enter the cavity of the latter, as it becomes invested by a reflection of its lining membrane. The artery, in the next place, passes horizontally forwards to the base of the anterior clinoid process, where it curves upwards, and pierces the superficial or cerebral lamella of the cavernous sinus; finally, becoming invested by the arachnoid membrane, it reaches the fissure of Sylvius, in which it divides into its terminal branches. Whilst in the canal, the artery is enclosed in a plexus formed by the sympathetic nerve, and gives off a small branch, which enters the tympanum, and anastomoses with the stylo-mastoid and tympanic arteries. Whilst at the sinus, a small twig is sent to the dura mater (r. meningeus anterior). The ophthalmic artery is given off close by the anterior clinoid process.

The *Ophthalmic artery* (plate VII. fig. 5, 6, b, b; a. ophthalmica) passes forwards from the internal carotid artery, where it lies by the anterior clinoid process, and enters the orbit by the foramen opticum, placed inferior and external to the optic nerve. It soon changes its direction, passing above and to the inside of the nerve, to reach the inner wall of the orbit, along which it runs, and finally terminates by branches that ramify on the side of the nose.

Its branches are very numerous, being intended to supply the eye and its appendages.

Ramus lachrymalis (plate VII. fig. 5, c) is of considerable size, and passes forwards, while the artery lies to the outside of the optic nerve. It runs close by the upper border of the external rectus muscle, which guides it to the lachrymal gland, to which the greater number of its branches are distributed; some, however, pass onwards to the eye-lids, and one or two delicate vessels pierce the malar bone to reach the temporal fossa.

r. Centralis retinae is a very small branch, which pierces the substance of the optic nerve, and runs embedded within it until it arrives on a level with the retina, where it divides into minute branches, which ramify in the anterior or vascular lamella of that membrane; a branch will be observed also to pass through the vitreous humour, and to reach the posterior surface of the capsule of the crystalline lens.

r. Supra-orbitalis ascends to get above the muscles, and in its course forwards to the supra-orbital notch lies immediately beneath the roof of the orbit. The artery mounts towards the forehead, and distributes several branches, which communicate with those of the temporal artery.

r. Ciliares (plate VII. fig. 6, g) are divisible into three sets; viz. short, long, and anterior ciliary arteries. The short ciliary arteries vary from twelve to fifteen in number, and will be found to enclose the optic nerve as they pass forwards to reach the posterior aspect of the sclerotica, which they pierce about a line or two from the entrance of the optic nerve. These ramify minutely in the choroid membrane. The long ciliary arteries, two in number, lie one at each side of the globe, as they pass forwards between the choroid membrane and the sclerotica. Each of them passes through the ciliary ligament, and divides into two branches, which, by anastomosing with one another and with the anterior ciliary arteries, form a vascular zone round the circumference of the iris. From this minute branches pass inwards, again subdividing and anastomosing, the last circle corresponding with the margin of the pupil. The anterior ciliary arteries are derived from some of the muscular branches; they pierce the sclerotica within a line or two of the margin of the cornea, and communicate with the preceding as they ramify in the iris.

r. Musculares are subject to many varieties in their course and distribution, like all muscular vessels: they supply the muscles of the orbit.

r. Ethmoidales (plate VII. fig. 5, e, e) are two in number; one passes through the posterior foramen in the inner wall of the orbit, and having given some small branches to the posterior ethmoidal cells, enters the skull, and sends minute filaments through the foramina of the cribriform lamella to the nasal fossæ. The other branch passes with the nasal division of the ophthalmic nerve through the anterior foramen, and having given ramusculi to the anterior ethmoidal cells and frontal sinuses, reaches the skull, and, like the preceding, sends its ultimate branches through the cribriform lamella to the nose.

r. Palpebrales (superior et inferior; fig. 5, h) arise usually in common, but soon diverge as they pass forwards, one lying above, the other below, the tendon of the orbicularis muscle: they are distributed, as their names imply, to the eye-lids, branches being also sent to the caruncula and lachrymal sac.

r. Nasalis (fig. 5, g) passes forwards to the root of the nose, and there ramifies minutely, maintaining a free communication with the termination of the facial artery.

r. Frontalis runs close to the preceding, but on reaching the margin of the orbit turns upwards on the forehead, where it anastomoses with the supra-orbital artery.

After having pierced the inner lamella of the dura mater, the internal carotid artery gives off the following branches:—

Ramus communicans posterior (plate VII. fig. 4, h, h) runs directly backwards, parallel with its fellow of the opposite side, so that they enclose within them the infundibulum, with the corpora mammillaria, and both terminate in the posterior cerebral arteries; thus forming the sides of the circle of Willis. In some instances I found two communicating branches, one being very small—about the size of a horse-hair. In one case, there were two at the right side, and one only at the left.

r. Cerebri anterior (plate VII. fig. 4, k, k) arises from the division of the internal carotid opposite the inner termination of the fissure of Silvius. From this point it inclines forwards and inwards to reach the margin of the longitudinal fissure between the cerebral hemispheres, in which it is connected with its fellow of the opposite side by a branch not more than two lines in length (*r. communicans anterior*). The two arteries in the next place, lying close together, turn around the anterior border of the corpus callosum, and, on reaching its upper surface, run from before backwards upon it, overlapped by the cerebral hemispheres. In this course numerous branches are given off to the cerebral convolutions.

r. Cerebri medius inclines obliquely outwards, taking the course of the fissure of Silvius, within which it divides into several branches, for the supply of the anterior and middle lobes of the brain. Some of these branches, as they ramify in the pia mater, turn forwards to the substantia perforata antica; and one or two will also be observed to enter the fissure between the middle lobe and the crus cerebri, to reach the descending cornu of the ventricle, where they are distributed to the plexus choroides (*rami choroidei*).

A remarkable inosculation exists between the branches of the vertebral and carotid arteries, by which the circulation in the brain is equalized, and any deficiency that may arise from the obliteration of one, or even two of the vessels, is speedily supplied by the others. This inosculation, which is known as the circle of Willis, results from a direct communication between the following branches. The anterior cerebral arteries, as they converge, are connected by their anterior communicating branch. These, or rather the trunk from which they arise, are united by the reflected communicating branches with the posterior cerebral arteries, and the two latter are united with the basilar artery at its point of termination. Within the area thus included will be observed the commissure of the optic nerves, the infundibulum and tuber cinereum, the corpora mammillaria, and the origins of the third pair of nerves.

ARTERIES OF THE UPPER EXTREMITY.

The arterial trunk which supplies the upper extremity continues undivided from its commencement as far as the bend of the elbow; but, like that of the lower extremity, different parts of it have received different names, according to the regions in which they are seated. Whilst in relation with the clavicle, which comprises all that part of the vessel intercepted between its commencement and the lower border of the first rib, it is called *subclavian*; from the point just indicated, to the border of the axilla, it is named *axillary*; and from thence to the bend of the elbow, *brachial*. This mode of division is analogous to that of the inferior arterial trunk into iliac, femoral, and popliteal; and the analogy is completed by the fact, that as the one ultimately divides into the radial and ulnar branches, so does the other into tibial and fibular. As the subclavian artery commences on the left side at the arch of the aorta, and on the right at the division of the brachio-cephalic artery, opposite the sterno-clavicular articulation, the vessels of opposite sides must differ materially in length and relations to contiguous structures in the first part of their course. They both agree, however, in arching upwards and outwards across the lower part of the neck, and in descending beneath the clavicle and subclavius muscle, as far as the lower border of the first rib, where they assume the name of axillary.

The subclavian artery (arteria subclavia).—The two vessels of this name differ in length, relations, and size, in which particulars they may be compared and contrasted as follows:—

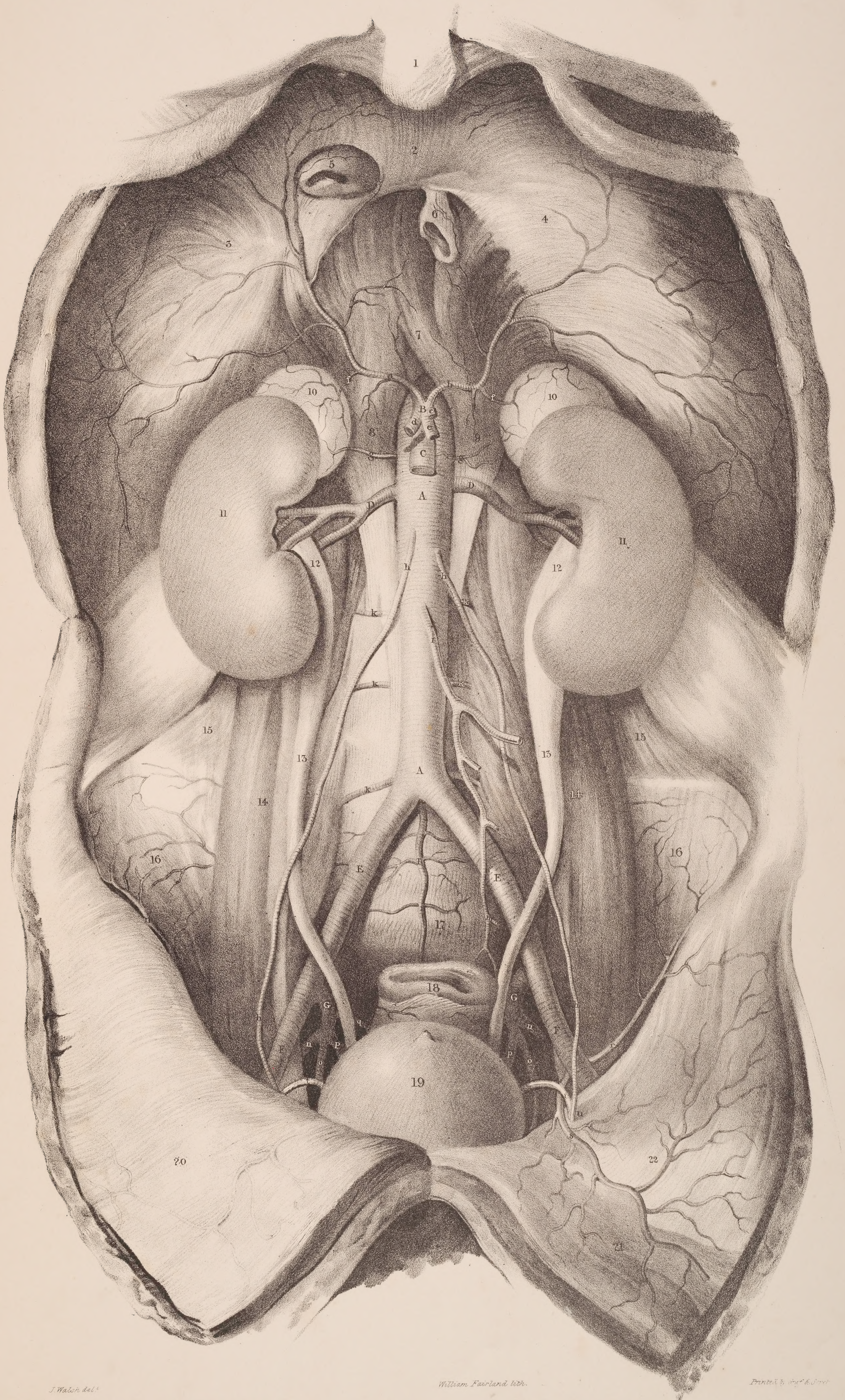
PLATE XIV.

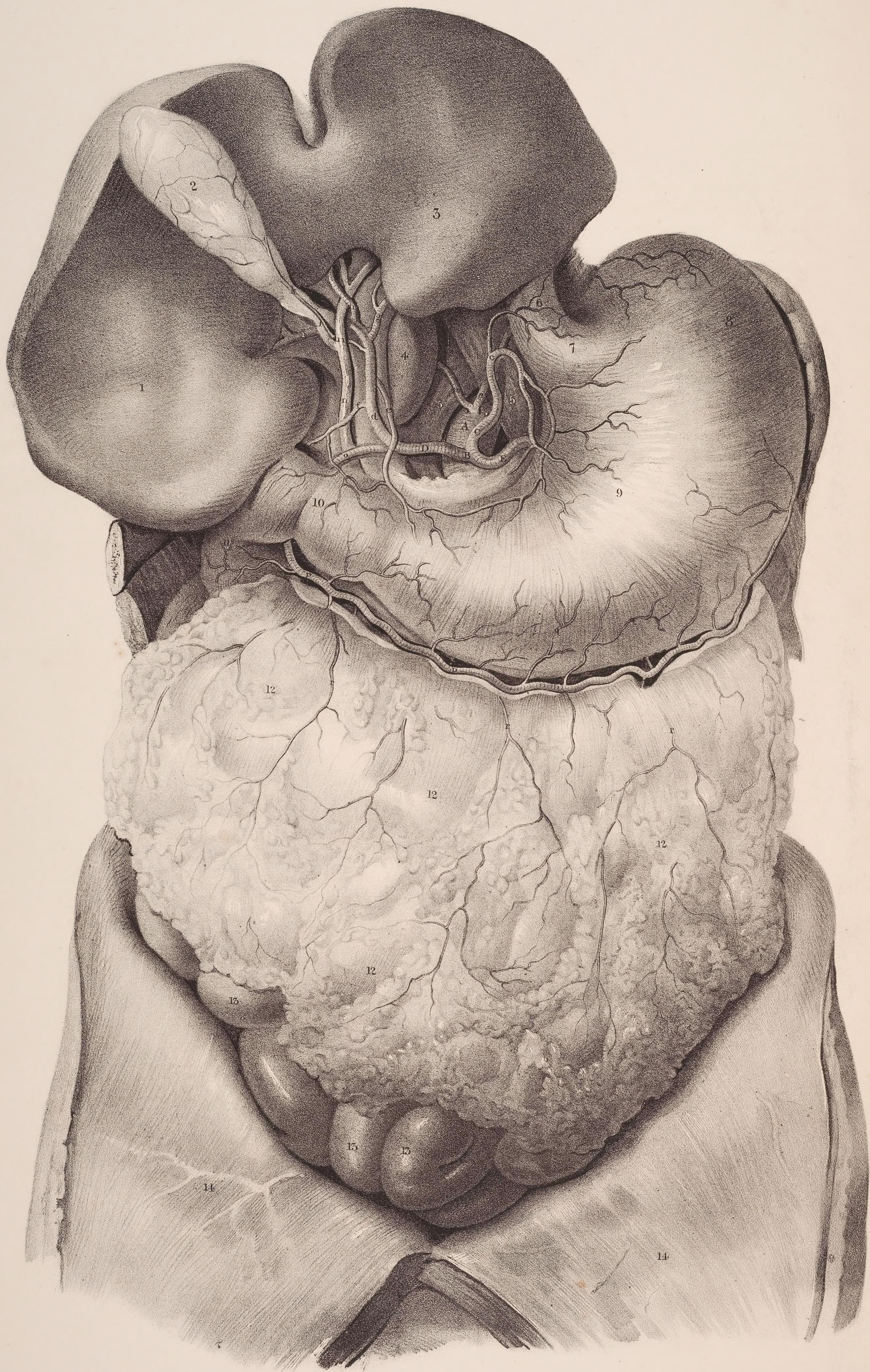
The trunk of the aorta within the abdomen is here shown, together with its different branches.

No. 1. The ensiform cartilage. 2, 3, 4. The divisions of the tendon of the diaphragm. 5. The inferior vena cava as it passes through the opening appropriated to it in the diaphragm. 6. Part of the œsophagus as it passes through the diaphragm. 7. The fibres which pass from one crus of the diaphragm to the other, and form the boundary of the aperture which transmits the aorta. 8, 9. The two crura of the diaphragm. 10, 10. The supra-renal capsules. 11, 11. The kidneys. 12, 12. The pelvis of the kidney at each side. 13, 13. The ureters. 14, 14. The psoas muscles. 15, 15. The quadratus lumborum of each side. 16, 16. The iliacus muscles. 17. The anterior surface of the sacrum. 18. Part of the rectum. 19. The fundus of the bladder. 20. The parietes of the abdomen everted and thrown down on the thigh. 21. Part of the rectus abdominis muscle at the left side exposed by removing the peritoneum and fascia transversalis. 22. The transversalis muscle.

A, A. The trunk of the aorta in the abdomen. B. The celiac artery, or axis arising from the aorta: it gives off three branches, which are marked c, d, e. C. The superior mesenteric artery. D, D. The renal or emulgent artery. E, E. The common trunk of the iliac arteries, into which the aorta divides at its termination. F, F. The external iliac arteries. G, G. The internal iliac arteries.

a, b. The two phrenic arteries which are distributed to the diaphragm. c. The coronary artery of the stomach (ramus coronarius ventriculi). d. The hepatic artery (r. hepaticus). e. The splenic artery (r. splenicus). f, f. Small branches which are given by the phrenic arteries to the supra-renal capsules. g, g. The capsular arteries. h, h. The spermatic arteries. i. The inferior mesenteric artery. k, k, k. The lumbar arteries. l. The middle sacral artery. m. The superior hæmorrhoidal artery, which is the lower or terminal branch of the inferior mesenteric artery. n. The gluteal artery derived from the internal iliac. o. The obturator artery. p. The ischiadic artery. q. The lateral sacral artery. r. The circumflex ilii artery. s. The epigastric artery. t. The vas deferens. u. The internal abdominal ring.





The right Subclavian artery (plate IV. D, E), which is usually a little larger than the left, having commenced at the division of the brachio-cephalic artery, behind the sterno-clavicular articulation, arches upwards and outwards to reach the margin of the scalenus anticus. It there inclines outwards and downwards, beneath the clavicle and subclavius muscle, and becomes continuous with the axillary artery, at the lower border of the first rib. The vessel lies on a plane anterior to that of the left side, inasmuch as the brachio-cephalic artery, from which it arises, is borne forwards by the trachea; in its course it describes a curve, whose convexity looks upwards, approaching the lower nerve of the brachial plexus, whilst its concavity looks downwards, resting on the pleura and first rib. The subclavian vein lies on a plane anterior to the artery, being separated from it by the scalenus anticus muscle, but is somewhat lower down, so as not to obscure or overlap it, except when much distended.

Now, previously to reaching the scalenus, the artery is covered by the skin, the cervical fascia, and by the origin of the sterno-mastoid muscle, and is overlapped by the sterno-hyoideus and sterno-thyroideus muscles; it is also crossed by the nervus vagus, (whose recurrent laryngeal branch passes behind it,) by some branches of the sympathetic nerve, and more externally by the internal jugular vein. In the next part of its course (where it lies behind the scalenus anticus) the artery is still covered by the sterno-mastoid to an extent dependent on the breadth of the clavicular attachment of that muscle: the subclavian vein and the phrenic nerve are here anterior to the artery, but separated from it by the scalenus anticus, on which they rest. But externally to the scalenus, the artery, though still deeply seated, is covered only by the skin, platysma, and fascia (superficial and deep-seated), and by some cellular membrane. Here it will be found lodged in a triangular interval, the base of which is formed by the clavicle, and the sides by the scalenus anticus and omo-hyoideus muscles. In the space just indicated, the external jugular vein opens into the subclavian vein. Two arterial branches (posterior scapular and supra-scapular) pass transversely outwards in the same situation—the latter being usually behind the clavicle; the brachial plexus of nerves lies superior and external to the artery, one branch being in close relation to it; the subclavian vein is, as has been above stated, anterior but at the same time inferior to the artery. This is the situation in which the artery can be most easily compressed or ligatured. (Plate I. Nos. 28, 29, 30; Plate II. A.)

The left Subclavian artery arises from the transverse part of the aortic arch at its most depending point, and thence ascends, almost perpendicularly, to get above the level of the first rib, lying close to the vertebræ, and supported by the longus colli muscle. It is overlapped by the upper lobe of the left lung and the reflected part of the pleura, and crossed at its lower part by the nervus vagus (which had previously been parallel with it), and above by the left brachio-cephalic vein, and by the sterno-thyroid and sterno-hyoid muscles: all these are interposed between it and the sternum. The artery lies along the left side of, and close to the œsophagus. On reaching the margin of the first rib it turns suddenly outwards, behind the scalenus anticus, and thenceforward follows the same course, and maintains the same relations as the right subclavian. But up to that point it lies so deeply, and changes its course so suddenly when passing outwards behind the scalenus, that it is deemed impossible to apply a ligature upon it previously to reaching that muscle,—an operation which has been performed with success on the corresponding part of the right subclavian artery. (Plate I. Nos. 21, 29, 30.)

PLATE XV.

The arteries of the liver and stomach are here shown.

- No. 1. The right lobe of the liver. 2. The gall-bladder. 3. The left lobe of the liver. 4. The lobulus Spigelii. 5, 5. The crura of the diaphragm. 6. The œsophagus. 7. Indicates the situation of the cardiac orifice of the stomach. 8. The great cul-de-sac of the stomach. 9. The middle part of the stomach. 10. The pyloric orifice. 11. The duodenum. 12, 12, 12. The great omentum. 13, 13, 13. Some convolutions of the small intestines. 14, 14. The walls of the abdomen everted.
- A. The abdominal aorta. B. The coeliac axis where it branches into three vessels, which go to the stomach, the liver, and the spleen. C. The coronary artery of the stomach (arteria coronaria ventriculi). D. The hepatic artery (arteria hepatica). E. The splenic artery (arteria splenica).
- a, a. The phrenic arteries (ramusculi phrenici). b. The ascending œsophageal branch of the coronary artery. c. The continuation of the coronary artery turning back to its anastomosis with the pyloric branch of the hepatic artery. d. The hepatic, or ascending branch of the hepatic artery. e. Its pyloric branch. f. A branch to the duodenum. g. The branch to the left lobe of the liver. h. The middle hepatic branch. i. The right hepatic branch. k. The cystic branch. l. The cystic duct. m. The hepatic duct. n. The common biliary duct (ductus communis choledochus). o. The gastro-duodenal artery (a. gastro-duodenalis). p, p. The continuation of the same vessel where it assumes the name of right gastro-epiploic artery (a. gastro-epiploica dextra). q, q, q. Branch from this vessel to the stomach. r, r, r. Branches to the omentum.

Seven branches proceed from the subclavian artery, each to a different destination; three of them however, in most cases, arise by a common trunk.

The vertebral artery passes up almost in the course of the original vessel, and is conducted by the foramina in the transverse processes of the cervical vertebræ to the base of the brain, the internal mammary artery turns downwards and forwards; the thyroid inclines upwards and inwards to the fore part of the neck: the supra-scapular and the posterior scapular pass outwards across the lower part of the neck, whilst the deep cervical and the superior intercostal pass backwards, and lie deeply, to gain their respective destinations.

The Vertebral artery (plate V. fig. 2, g; ramus vertebralis) is a principal branch of the subclavian artery. It enters the foramen in the fifth or sixth cervical vertebra, and ascends vertically along the canal formed by the chain of foramina in the transverse processes, as far as the axis, at which point it inclines outwards, in consequence of the greater width of the atlas. Having passed through the latter, it winds backwards round its articulating process, lying in a shallow groove behind it; and having pierced the dura mater, enters the skull through the foramen magnum. The vessel finally passes forwards, converging to that of the opposite side, and unites with it, their conflux forming the basilar artery.

The Basilar artery (plate VII. fig. 4, d, d) is so named from its lying on the basilar process of the occipital bone: its length corresponds very nearly with the breadth of the pons Varolii, beneath which it lies, and at whose anterior border it divides into four branches, two for each side. The vertebral artery in its ascent is accompanied by a vein of the same name which commences by branches at the base of the skull, and comes into contact with the artery at the first vertebra. Both vessels lie anterior to the series of cervical nerves, which they cross at right angles. The branches of the vertebral artery in the neck consist of small twigs given off at different points of its course to the dura mater of the spine, and some of variable size to the deep-seated cervical muscles: those within the skull are the following:—

r. Meningeus posterior, which is a small branch that arises when the artery is opposite the foramen magnum, and ramifies upon the neighbouring part of the dura mater.

r. Inferior cerebelli (plate VII. fig. 4, c) arises at the side of the medulla oblongata, and turns backwards and outwards beneath the corresponding lobe of the cerebellum, to which it distributes numerous ramifications, some of which extend to the inferior vermiform process, and to the fourth ventricle, through the medium of its choroid plexus. There is another of the same name farther forward, e.

r. Spinalis posterior inclines backwards round the medulla oblongata, to reach the posterior surface of the medulla spinalis, along which it descends, parallel with its fellow of the opposite side, as far as the second lumbar vertebra, where it terminates in ramifications on the cauda equina. Both these vessels are long and tortuous, and maintain frequent communications by transverse branches.

r. Spinalis anterior, (plate VII. fig. 4, b,) smaller than the preceding, descends in front of the medulla oblongata, and unites with the corresponding branch of the opposite side, immediately below the foramen magnum, so as to form one long vessel, which descends in the middle line in front of the medulla spinalis, at the extremity of which it passes through the nervous filaments forming the cauda equina, and terminates at the lower part of the canal in delicate ramifications. This and the preceding branch give numerous ramusculi to the spinal cord and its nerves, and communicate with the branches which enter through the intervertebral foramina.

The branches of the basilar artery are the following:—

Several ramuli are given to the cerebral protuberance and adjacent nerves: one also accompanies the acoustic nerve into the labyrinth of the ear.

Ramus cerebelli superior (plate VII. fig. 4, f) turns backwards and outwards round the upper margin of the pons Varolii, to reach the superior surface of the cerebellum, upon which it ramifies freely.

r. Posterior cerebri (plate VII. fig. 4, g) is larger than the preceding, and separated from it by the third nerve; it turns round the crus cerebri, and inclines backwards to the posterior lobe of the cerebrum, along which it distributes numerous branches, for the supply of its substance. At the point where this vessel turns backwards, it receives the communicating artery from the internal carotid, and so contributes to form the circle of Willis.

The inferior Thyroid artery (plate IV. 1; plate V. fig. 2, e; r. thyroideus inferior—ascendens). The inferior thyroid artery is not unfrequently called *thyroid axis*, because, immediately after its origin, it divides into three branches, which diverge in different directions, viz. the inferior or ascending thyroid, the transversalis colli, and transversalis humeri. It springs from the upper surface of the subclavian artery at a point nearly opposite to that from which the internal mammary artery arises, and to the inner

side of the anterior scalenus muscle. At first it presents the appearance of a short stunted trunk; but a line or two from its origin it greatly diminishes in size, owing to its giving off the branches above named. It passes upwards, resting on the longus colli, but soon turns inwards, behind the sheath of the cervical vessels and the sympathetic nerve, directing its course to the thyroid gland, in which its final branches ramify, and where they communicate freely with those of the superior thyroid artery, derived from the carotid.

Ramulus Cervicalis ascendens (plate IV. m). At the point where the inferior thyroid changes its direction, a branch (ascending cervical) usually arises from it, and proceeds upwards, on the line of junction formed by the scalenus anticus and rectus anticus major, ramifying on these muscles, and communicating with the ramusculi sent outwards from the vertebral artery.

r. Glandulares are the terminal branches given to the thyroid gland.

The Supra-scapular artery (plate IV. n; r. supra-scapularis—transversalis humeri) is smaller than the succeeding branch (r. scapularis posterior); it arises almost constantly from the thyroid artery, seldom from the subclavian. It runs from within outwards, lying deeply at the root of the neck, and rests at first upon the scalenus anticus, then crosses the subclavian artery, taking a transverse course under cover of and parallel with the clavicle, to reach the root of the coracoid process of the scapula. At this point it is separated from the corresponding nerve by the ligament stretched across the supra-scapular notch, as the nerve usually passes through the foramen.

Ramulus Supra-spinalis:—On reaching the supra-spinous fossa, the artery lies close to the bone, and sends outwards a branch (supra-spinal) which ramifies in the supra-spinatus muscle.

r. Infra-spinalis (plate VIII. k). Continuing to descend, the artery in the next place passes through the interval between the glenoid cavity and the spine of the scapula, resting on the neck of that bone, and so reaches the infra-spinous fossa, where it supplies the muscle of that name, and at the same time communicates with the dorsal branch of the sub-scapular artery, and the termination of the scapularis posterior.

r. Musculares:—In its course across the neck some ramuli are given by this vessel to the muscles by which it passes.

r. Acromialis:—A small though regular branch will also be found to pass obliquely downwards to reach the cutaneous surface of the acromion, on which it distributes several twigs, which anastomose with those of the thoracico-acromial branch.

The posterior Scapular artery (plate IV. o; r. scapularis posterior—transversalis colli) is much more frequently derived from the subclavian itself than from the inferior thyroid; it runs directly outwards across the lower part of the neck, resting on the scaleni muscles and the axillary plexus of nerves, but sometimes passing through the divisions of the latter. On reaching the posterior angle of the scapula it changes its direction, and turns downwards, along the base of that bone, so far as its inferior angle, where it freely anastomoses with the subscapular branch of the axillary artery. It lies deeply in its entire course, and gives off several branches.

r. Cervicalis superficialis:—Opposite the anterior border of the trapezius a branch passes upwards, becoming superficial (hence its name), and distributes ramusculi in the interval between the trapezius and sterno-mastoid muscles, supplying both, as well as the cervical glands and integuments.

r. Posterior scapulae (plate VIII. b).—The proper *posterior scapular* branch is in fact the continuation of the vessel, and will be found at the posterior angle of the scapula under cover of the levator anguli muscle, and subsequently under the rhomboidei, to which it gives several branches, as well as to the latissimus dorsi and intercostal muscles, anastomosing at the same time with the intercostal arteries. Towards the inferior angle of the scapula its terminating branches will be found to establish a free anastomosis with the subscapular artery and its dorsal branch.

The deep Cervical artery (plate V. fig. 2, k; r. profundus cervicis) is subject to many varieties in its point of origin as well as size. It frequently arises by a short trunk common to it and the superior intercostal artery, or may come even from the thyroid or vertebral. It passes backwards in the interval between the transverse processes of the sixth and seventh cervical vertebrae, and on reaching their dorsal aspect ascends, still deeply seated, between the semi-spinalis colli and the complexus, and sends off several branches to the surrounding muscles. Some of these communicate with ramusculi sent outwards from the vertebral artery, whilst others ascend to anastomose with the descending branch (*princeps cervicis*) of the occipital artery.

The internal Mammary artery (plate VII. fig. 2, n; r. mammarius internus) turns forwards from the subclavian to reach the inner surface of the first rib, and then descends between the pleura and the costal cartilages, as far as the cartilage of the seventh rib. At this point it divides into two branches, one of

which inclines outwards, along the margin of the thorax, the other continues in the original direction of the vessel, down to the abdomen. Its branches, including the two just alluded to, are the following:—

Ramulus Comes nervi phrenici is a very small branch, which joins the phrenic nerve where it passes over the mammary artery, or a little lower, and accompanies it to the diaphragm, to which its ramusculi are distributed, anastomosing with the phrenic arteries derived from the abdominal aorta, as well as with the phrenic branches given off by the musculo-phrenic division of the internal mammary.

Ramuli Mediastini:—Several small branches pass inwards to the cellular tissue in the anterior mediastinum, and also some to the anterior part of the pericardium.

r. Thymici:—One or more small branches are given off to the thymus gland.

r. Pericardiacus is a branch of variable size, which passes backwards into the upper part of the pericardium. Its lowest part receives twigs from *r. musculo-phrenicus*.

r. Intercostales anteriores (plate VII. fig. 2, o, p) pass outwards, at each intercostal space, between the pleura and internal intercostal muscles, then between the two layers of the latter, and inosculate with the vessels of the same name, derived from the aorta, maintaining communications at the same time with the thoracic branches of the axillary artery.

r. Musculo-phrenicus is the external division of the mammary artery. It inclines outwards, in the direction of the cartilages of the false ribs, sending branches, backwards into the diaphragm, and downwards to the abdominal muscles, whilst others pass outwards, in the intercostal spaces, being disposed in the same way as those which come higher up from the mammary artery itself.

r. Epigastricus superior continues in the direction of the mammary artery, passing behind the seventh costal cartilage to reach the parietes of the abdomen. It there lies between the rectus muscle and its sheath: it ramifies freely in the muscles, and anastomoses with the inferior epigastric branch, which comes up from the external iliac artery.

The superior Intercostal artery (plate VII. fig. 2, e; *r. intercostalis superior*) turns backwards, immediately after its origin, from the posterior aspect of the subclavian, and reaches the inner surface of the first rib, beneath which it sends outwards an intercostal branch, similar in course and distribution to those derived from the aorta. Opposite the second intercostal space another branch is given off, after which it terminates by a small ramulus that communicates with the first aortic intercostal branch. Some twigs are given to the upper part of the œsophagus, and some also enter the intervertebral foramina, to ramify on the dura mater of the spinal canal.

Varieties.—The branches of the subclavian artery present numerous variations in their mode of origin. The thyroid is of considerable size when it gives off the supra-scapular and posterior scapular

PLATE XVI.

Fig. 1. The stomach is here shown as it appears when drawn upwards; thus bringing into view the pancreas, duodenum, and spleen, with their respective arteries.

No. 1. The right lobe of the liver. 2. The gall-bladder. 3. The left lobe of the liver. 4. The middle part of the stomach. 5. Its large or left extremity. 6. The junction of the œsophagus with the stomach. 7. The lower part of the left lobe of the liver. 8, 8. The crura of the diaphragm. 9. The pylorus. 10, 10. The duodenum. 11, 11. The pancreas. 12. The spleen.

A. The abdominal aorta. B. The cœliac artery or axis. C. The coronary artery. D. The hepatic artery. E. The splenic artery. F. The superior mesenteric artery. G. The abdominal aorta.

a, a. The continuation of the coronary artery. b. The place of its anastomosis with the pyloric branch. c, c. Branches to the stomach. d. The pyloric branch of the hepatic artery. e, e. The phrenic arteries. f. The hepatic, or ascending branch of the hepatic artery. g. The gastro-duodenal branch. h. A small pyloric branch. i. The pancreatico-duodenal branch. k, k. The continuation of the gastro-duodenal artery where it assumes the name of right gastro-epiploic artery (*arteria gastro-epiploica dextra*). l. The hepatic artery at the transverse fissure of the liver: this and the cystic duct rest on the branches of the vena portæ. m. The cystic branch of the hepatic artery. n, n. The left gastro-epiploic artery derived from the splenic (*a. gastro-epiploica sinistra*). o, o. Branches to the stomach (*vasa brevia*). p, p. The branches to the spleen. q, q. Small branches to the pancreas (*rami pancreatici*). r. The lower pancreatico-duodenal branch derived from the superior mesenteric artery.

Fig. 2. In this drawing we have the arteries at both curvatures, and at the posterior aspect of the stomach.

No. 1. The œsophagus. 2. The cul-de-sac of the stomach. 3. Its middle part. 4. The pylorus.

a. The coronary artery. b. The pyloric branch. c, c, c. Branches descending to the stomach from the arch formed by these vessels. d. Vasa brevia from the splenic artery. e, e. The right gastro-epiploic artery. f, f. Anastomoses between the lower arch of arteries and the upper one. g, g. The left gastro-epiploic artery derived from the splenic.

Plate 16.

Fig. 1.

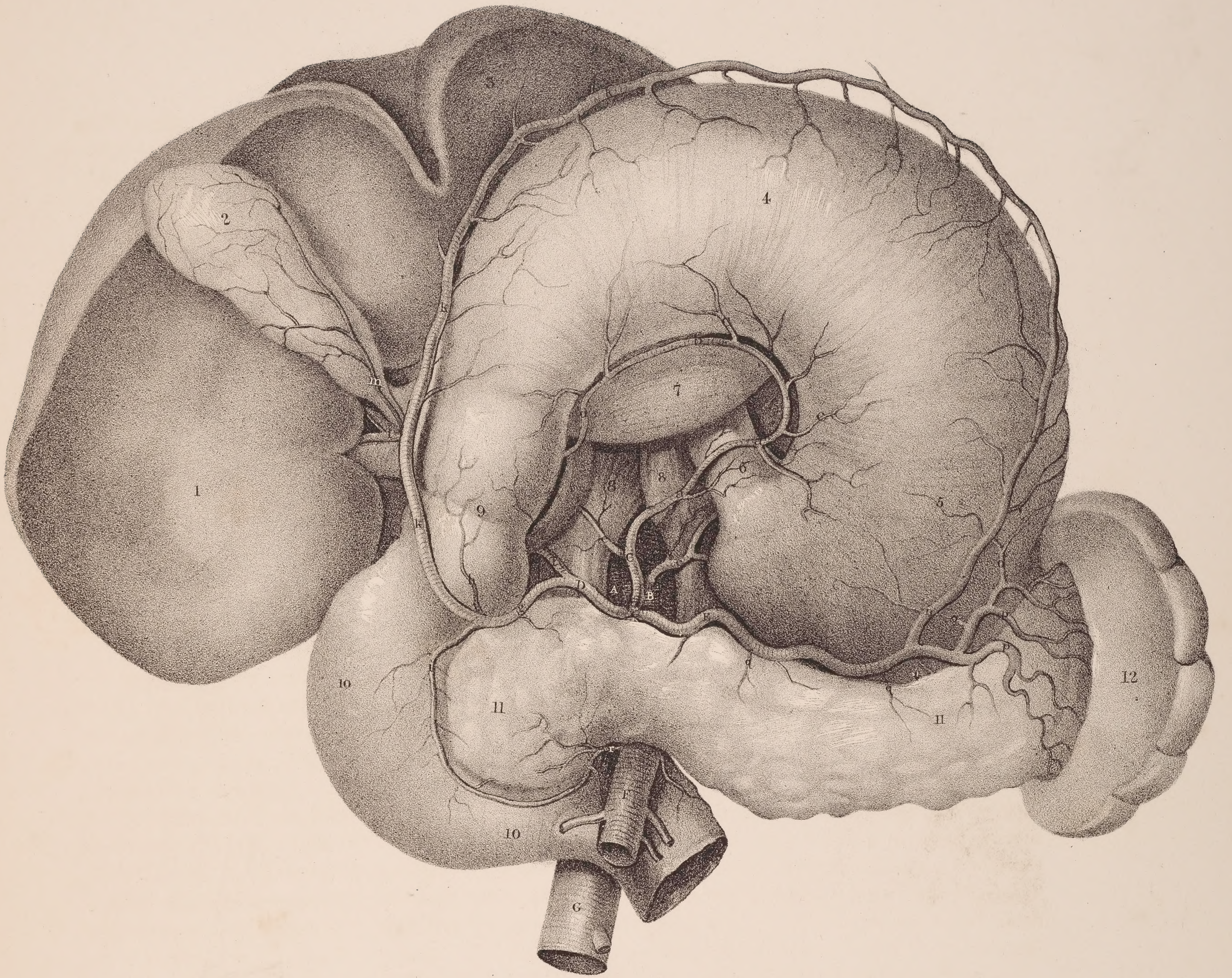
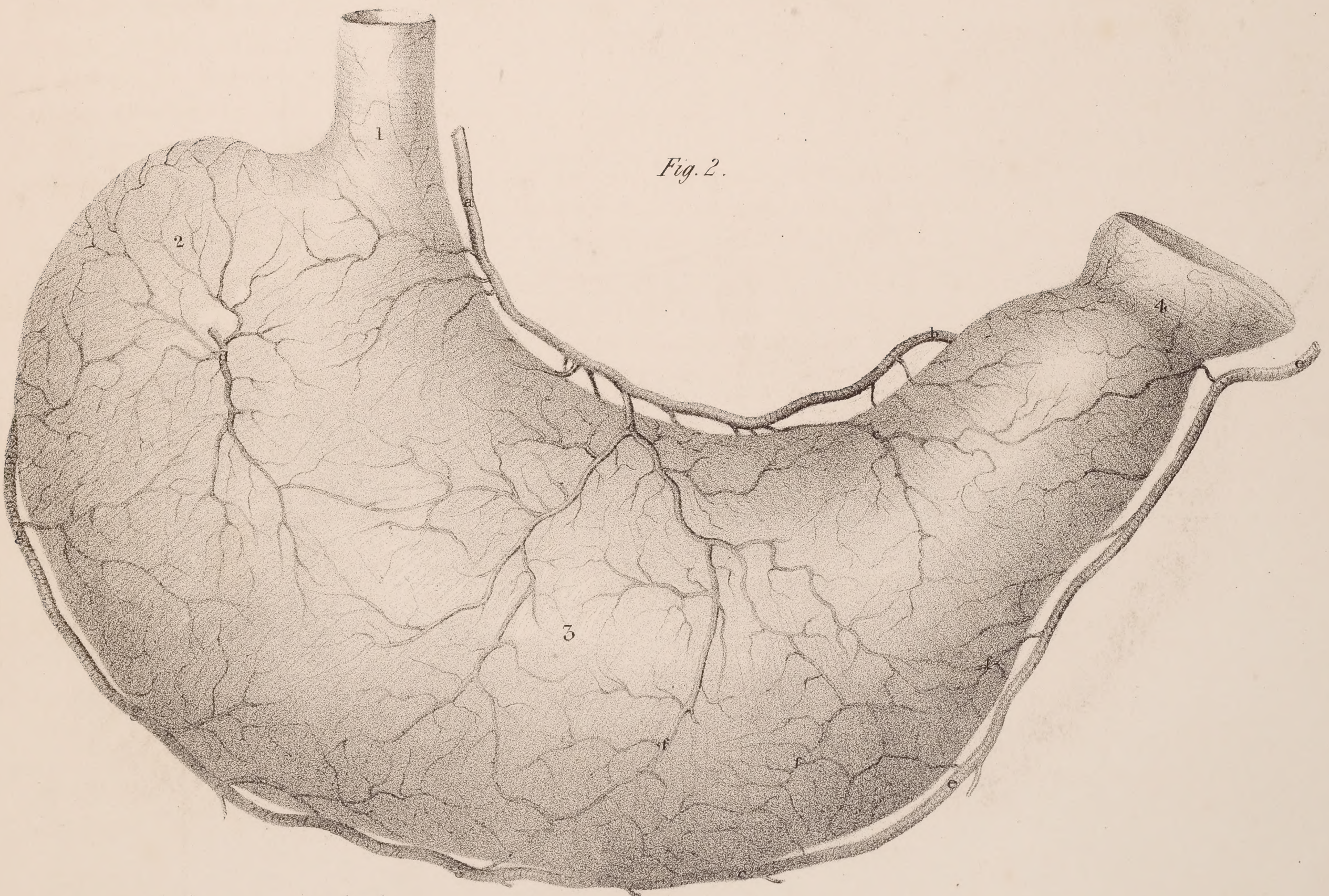


Fig. 2.

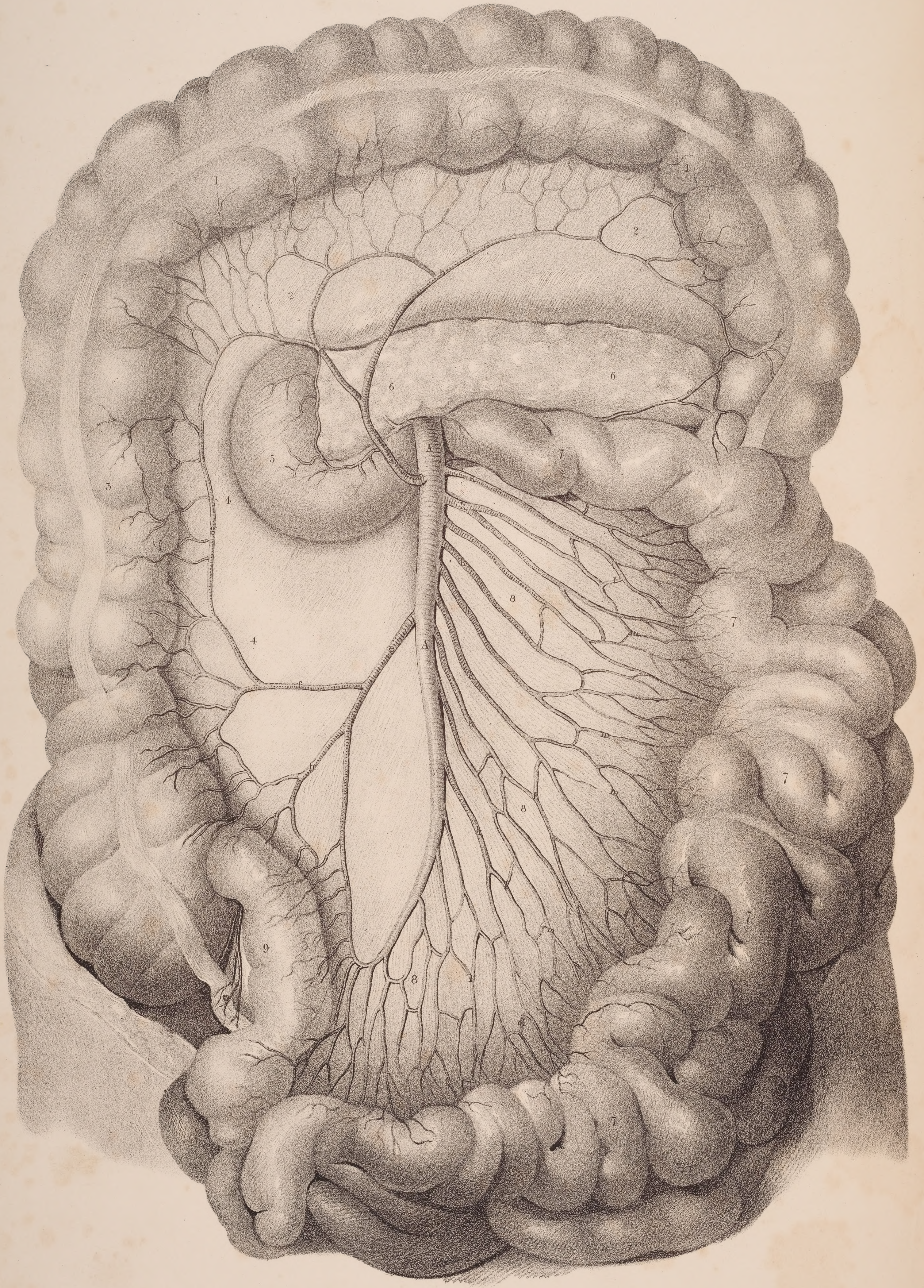


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branches, but is much reduced when it is merely a single vessel for the supply of the thyroid gland. In some cases which have been cited it did not exist; in others it arose from the arch of the aorta, and ascended upon the trachea to its destination. The possibility of such a distribution points out at once how necessary it is to be cautious in performing the operation of tracheotomy.

The posterior scapular branch very frequently comes off singly from the subclavian, in the latter part of its course, where it turns down upon the first rib. The first intercostal and the deep cervical frequently arise by a common trunk. We have already seen that the vertebral has been found arising from the aortic arch. A very singular variety is delineated by Tiedemann, in which the vertebral artery of the left side had two origins, one from the aortic arch, between the left carotid and left subclavian arteries, and the other from the latter vessel, which united and formed the vertebral opposite the fifth cervical vertebra. The mammary artery is very constant; in a few cases it has been known to come from the aortic arch or from the brachio-cephalic.

The Axillary artery (plate IV. F, G; a. axillaris) lies obliquely across the superior and lateral part of the thorax extending from the lower border of the first rib as far as the inferior margin of the tendons of the latissimus dorsi and teres major. In this short course the direction of the vessel is outwards, downwards, and a little backwards, so that when the arm hangs freely by the side, it describes a curve whose convexity looks towards the acromion, and concavity towards the chest. It is accompanied by the axillary vein and brachial plexus of nerves, which lie at different sides of it; hence, in order that we may state precisely the relation of these vessels, as well as of the muscles, to the artery, it becomes necessary to consider it, not as a cylindrical tube, but as if it were compressed so as to present four sides. The acromial side at first corresponds with a small cellular interval that separates it from the plexus of nerves, then with the divisions of the plexus which are in close contact with it, and lower down with the tendon of the sub-scapular muscle, and finally, at its termination, with the coraco-brachialis, which is interposed between it and the humerus. The thoracic side of the vessel rests on the first intercostal space, then on the first digitation of the serratus magnus muscle. When it passes off the chest into the axillary space, it lies in the cellular interval between the serratus and sub-scapularis, and becomes supported by the nerves which here surround the vessel. The anterior surface is covered by the pectoralis major and costo-coracoid ligament or membrane in the space between the subclavius and pectoralis minor, then by the latter and the pectoralis major together, and, finally, by the last-named muscle, which covers it to its termination. Its posterior surface is supported by some cellular membrane and the deep divisions of the brachial plexus of nerves. The axillary vein, at first separated from the artery by the insertion of the scalenus anticus muscle, lies inferior and internal to it, that is to say, to its thoracic side: lower down it comes in front of the artery, and conceals it from view when we look into the axillary space.

The space here referred to, when cleared of the cellular tissue and glands which fill it, is of a pyramidal form, the summit being at the interval between the scaleni muscles, and the base at the borders of the pectoralis and latissimus dorsi; its sides are formed as follow, viz. by the pectoral

PLATE XVII.

The superior mesenteric artery, and the branches which it gives to the small and large intestines, are here shown. Nos. 1, 1. The transverse part of the colon. 2, 2. The layer of peritonæum forming the posterior lamella of the transverse meso-colon, the anterior one being taken away in order to expose the vessels. 3. The ascending part of the colon. 4, 4. The posterior layer of the right meso-colon; the anterior one is removed to bring the vessels into view. 5. The descending part of the duodenum. 6, 6. The pancreas. 7, 7, 7, 7. The convolutions of the small intestines. 8, 8, 8. The posterior layer of the mesentery.

A, A. The trunk of the superior mesenteric artery (arteria mesenterica superior). a. The middle colic branch, which turns forwards to supply the transverse colon (arteria colica media, or ramus colicus medius); it is seen to divide into two branches, of which one goes to the left, and is marked b, by which it communicates with an ascending branch, c, from the inferior mesenteric artery. d. The descending or right branch of the middle colic artery; it turns downwards and communicates with the right colic artery. e. The right colic artery (arteria colica dextra, or ramus colicus dexter); it usually comes off as a separate vessel, but in this case the vessel serves as a common trunk, and gives off a branch, f, which occupies the place of the right colic artery, and another, h, the ilio-colic; the right colic anastomoses by an ascending branch, g, with the middle colic artery, whilst another inclines downwards and anastomoses with the ilio-colic. h. The ilio-colic artery (arteria ilio-colica, or ramus ilio-colicus) is intermediate in position between the right colic and the termination of the mesenteric artery. i. The termination of the mesenteric artery, where it inclines upwards to anastomose with the ilio-colic. k, k, k, k. Branches derived from the left side of the mesenteric artery for the supply of the small intestines. l, l, l, l. Communicating branches passing from one to the other, forming a net-work. m, m, m, m. Small branches proceeding directly to the intestines.

ARTERIES.

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muscles in front, by the latissimus and teres behind, the serratus magnus internally, and the sub-scapularis and head of the humerus externally. The brachial plexus of nerves is situated above, and to the outer side of the artery at its commencement; at about the middle of its course, the nerves surround it (the vessel being between the two roots of the median nerve); lastly, the branches proceeding from the plexus are disposed with regard to the artery as follows: the external cutaneous nerve and one root of the median lie at its outer side; the internal cutaneous, the second root of the median, and the ulna, at its inner side; and behind it the circumflex and musculo-spiral.

The axillary artery gives off seven branches, which are named as follows; premising, at the same time, that considerable variety obtains in their mode of origin.

The upper Thoracic branch (ramulus thoracicus supremus) is a very small twig which arises just above the border of the pectoralis minor, from the axillary artery itself, or from the thoracico-acromial branch. It inclines forwards and inwards, getting between the pectoral muscles, to which its ramifications are distributed; some of them also go to anastomose with those of the internal mammary and intercostal arteries.

The Thoracico-acromial branch (plate IV. p; r. thoracico-acromialis) arises from the fore part of the axillary artery, being rather a large branch. It projects forwards at the upper border of the pectoralis minor, and soon divides into branches which take opposite directions. One set inclines inwards to the thorax, the other outwards to the acromion, whence the vessel derives its name. The thoracic branches are three or four in number, and are distributed to the serratus magnus and pectoral muscles, their extreme terminations communicating with those of the other thoracic branches, as well as with the intercostal branches of the internal mammary artery. The acromial branches incline outwards, and subdivide into a descending and transverse set. The latter proceed towards the acromion, and are distributed partly to the deltoid muscle; whilst others, upon the upper surface of that process, maintain an anastomosis with branches of the supra-scapular and posterior circumflex arteries. The descending branch passes down in the interval between the pectoralis major and deltoid, and ramifies in both.

Ramulus thoracico-alaris is very small and variable in size, and altogether unimportant; it is merely distributed to the glands and cellular tissue in the axilla.

The long Thoracic branch (plate IV. x; r. thoracicus longus) passes downwards and inwards along the lower border of the pectoralis minor, and is distributed to the mamma, (hence it is often called external mammary,) to the serratus and pectoral muscles, and anastomoses with the external branches of the intercostal arteries.

The Sub-scapular branch (plate IV. t; r. sub-scapularis) is the largest branch given off by the axillary artery. It arises from that vessel, close by the lower border of the sub-scapular muscle, along which it proceeds downwards and backwards, soon becoming considerably diminished in size, owing to its giving off a large branch to the dorsum of the scapula. The continuation of the vessel (plate IV. w) proceeds down towards the inferior angle of the scapula, accompanied by the sub-scapular nerve, and lying on the muscle of that name, to which it gives branches, as well as to the serratus magnus and latissimus muscle. Its final ramifications anastomose with those of the posterior scapular artery, and with its own dorsal branch:—the dorsal branch.

Ramus dorsalis (plate IV. v.)—The branch just named passes backwards from the sub-scapular artery, about an inch and a half from its origin, and is larger than the continuation of the vessel. Turning round the lower border of the scapula, the dorsal branch passes, first through the interval between the sub-scapularis and latissimus dorsi muscles, and then between the teres major and minor, and may be always found in the fissure between the last-named muscles, immediately behind the long head of the triceps. It gives branches to these muscles, and, on reaching the dorsum of the scapula, ramifies extensively upon it, supplying the infra-spinatus muscle, and anastomosing with the supra-scapular and posterior scapular arteries.

The two following branches are called “circumflex” from the manner in which they pass, one before and the other behind the shaft of the humerus. They come off close to the lower border of the axilla as the axillary artery is about to merge in the brachial. They vary much in their mode of origin; they often arise by a common stem from the axillary artery or from its sub-scapular branch; sometimes the posterior one comes from the upper deep branch of the brachial artery.

The posterior Circumflex branch (plate IV. s; r. circumflexus posterior) is not so large as the sub-scapular, near which it arises. It passes backwards immediately after its origin, winds round the shaft of the humerus, lying between the bone and the long head of the triceps, having the teres major muscle below, and the teres minor above it; it terminates by ramifying in the deltoid muscle and on

the shoulder-joint, having previously communicated by branches with the anterior circumflex and supra-scapular arteries.

The anterior Circumflex branch (plate IV. r; r. circumflexus anterior) is much smaller than the preceding. It passes from within outwards and forwards, under the coraco-brachialis and inner head of the biceps muscle, resting on the fore part of the humerus, until it reaches the bicipital groove. There it divides into two branches, or, in some cases, into two sets of branches; of these, one ascends by the long head of the biceps through the groove in which it runs, and is distributed to the head of the bone and the capsule of the joint; the other continues outwards, in the original direction of the vessel, and, after anastomosing with the posterior circumflex branch, is lost in the deltoid muscle.

The Brachial artery (plate IX. figs. 1, 2, A, A; arteria brachialis vel humeraria) is placed along the internal and anterior aspect of the arm, extending from the lower border of the axilla to about a finger's breadth below the bend of the elbow. Its direction is downwards, outwards, and forwards, and may be marked out by a line drawn from midway between the borders of the axilla to the middle point between the condyles of the humerus; so that in the first part of its course the vessel is situated at the inner side of that bone, and inferiorly on its anterior aspect. The artery may be said to be superficial in its whole course, inasmuch as it can be exposed without dividing any muscular fibres, being covered merely by the skin and fascia.

The brachial artery in the upper part of its course rests on the triceps muscle, the spiral nerve however, and the profunda artery intervening; in the middle of the arm it crosses over the insertion of the coraco-brachialis muscle, and lies from thence to its termination on the brachialis anticus. Its external side is in apposition, in the upper half of the arm, with the coraco-brachialis; in the lower with the biceps, the borders of which muscles somewhat overlap it. The venæ comites are in close contact with the artery, short transverse branches of communication passing from one to the other, so as at many points to encircle it: the basilic vein is parallel and superficial to it, sometimes in its entire extent. The median nerve, though its two roots embrace the axillary artery, lies at first to the acromial side of the brachial; but as it descends it inclines in front of the vessel, crossing it about the middle of the arm, so that at the elbow it lies to the inner side of the artery, and on the same plane, both being supported by the brachialis anticus muscle. The nerve usually crosses in front of the artery, but in some instances behind it. The internal cutaneous nerve is superficial to the artery, but it does not lie exactly in front of it; for, at the elbow, the nerve is to its inner side, and maintains a similar relation higher up.

At the bend of the arm the artery sinks deeply into an angular interval, enclosed between the pronator teres and supinator radii longus. In this situation the vessel is covered by the fascia of the arm, and crossed by the fibrous process which passes from the tendon of the biceps to that membrane, and separates the artery from the median basilic vein: it rests on the brachialis anticus muscle, having the tendon of the biceps on the radial, the median nerve on the ulnar side, and finally, opposite the insertion of the brachialis anticus, it divides into the radial and ulnar arteries. The position of the artery with regard to the shaft of the humerus deserves particular attention. Superiorly it is parallel with, and to the inner side of the bone, and inferiorly lies directly in front of it. In the former situation, therefore, in order to compress the vessel, the pressure must be directed from within outwards; in the latter, from before backwards; and at the intermediate point the direction of the pressure must also be intermediate, that is to say, backwards and outwards.

The brachial artery in its course gives numerous branches to the muscles by which it passes; none but the following have received names, or require description.

The superior Collateral artery (plate IX. figs. 1, 2, c; arteria profunda superior), having started from the back part of the artery, just below the border of the teres major, inclines downwards and outwards, to reach the interval between the second and third heads of the triceps. In this course it is accompanied by the musculo-spiral nerve, and both, continuing the same oblique direction, pass between the second head of the triceps and the bone, to reach its external and anterior aspect. In the latter situation, the artery lies deeply in the fissure between the brachialis anticus and supinator longus muscles, considerably diminished in size, by having given off several branches, and descends to the elbow, where it anastomoses with the recurrent branch of the radial artery. The only off-set from this artery that requires a special notice, is one which descends perpendicularly from it, when lying behind the middle of the humerus, and proceeds between the triceps muscle and the bone to the back part of the elbow-joint, where it anastomoses with the interosseous recurrent branch. This vessel is sometimes given off by the sub-scapular artery or by the posterior circumflex.

Ramulus nutritius.—This is a very small branch given off by the brachial artery about the middle

of the arm, or by one of its collateral branches. It inclines downwards and enters the oblique canal in the humerus near the insertion of the coraco-brachialis muscle, and is distributed to the medullary membrane.

The inferior Collateral artery (plate IX. f; a. profunda inferior) is of small size, and arises from the brachial artery, a little below the middle of the arm. Its direction is downwards and inwards, from the point just indicated, to the back part of the inner condyle of the humerus; to gain which it, in the first place, pierces the intermuscular ligament or septum, and then lies on the inner surface of the triceps (its third head), to which it gives branches. In this course the artery lies parallel, and on the same plane, with the ulnar nerve, and enters the interval between the olecranon and inner condyle, where it terminates by anastomosing with the posterior recurrent branch of the ulnar artery.

The Anastomosing branch (plate IX. figs. 1, 2, i; ramulus anastomoticus), though a very small branch, is almost constant in its occurrence; it arises from the brachial artery, about two inches above the bend of the arm. Resting on the brachialis anticus, this little vessel descends towards the inner condyle, and divides into two sets of ramifications. Of these, one lies in front of the articulation, and after supplying the brachialis anticus and pronator teres muscles, anastomoses with the anterior ulnar recurrent, whilst the other passes backwards, comes into relation with the ulnar nerve, and communicates with the branches of the r. ulnaris recurrens and of the r. profundus inferior.

It must be obvious, that the terms applied to the branches of the brachial artery are rather ill chosen. The r. inferior profundus lies beneath the fascia, and is superficial rather than deep-seated; and the property of anastomosis is common to all, as well as the small branch called anastomoticus magnus or major. The first branch may, with propriety, be named "profundus," from its situation, or "spiral," from its direction; and the two others "collateral," from their relation to the artery itself; so they were named formerly by Winslow, and still by Boyer.

Varieties.—The description above given of the course, relations, and mode of division of the brachial artery, is conformable with what obtains in the greatest number of instances. Some varieties, however, occur which deserve notice. The vessel not unfrequently divides as high as the middle of the arm, or even higher, or rather gives off one of its two terminal branches, which most commonly is the radial. On this subject Meckel states, as the result of his observations, that when the radial artery arises in the arm, it usually commences towards the middle point; but that the anomalous division of the ulnar, though less frequent in its occurrence, takes place in most instances higher up, even as high as the point at which the axillary terminates in the brachial. I found in the dissecting-room a few years ago a variety not hitherto noticed. It was at first taken for the ordinary high division of the ulnar artery. The two vessels descended from the point of division at the border of the axilla, and lay parallel with one another in their course through the arm; but instead of diverging, as is usual, at the bend of the elbow, they converged and united so as to form a short trunk, which soon divided again into the radial and ulnar arteries in the regular way. The femoral artery presented a conformation in every particular similar to this in the person of an individual who was the subject of popliteal aneurism, for which an operation was performed by Sir Charles Bell. The pulsation was not stopped when the ligature was applied to the vessel. When the radial arises high up from the brachial artery, it may be situated parallel and internal to that vessel, or may turn suddenly outwards across it, becoming in a manner superficial to it, but still covered by the fascia. Tiedemann says that in such cases the "radial artery is either enclosed by the aponeurosis of the arm, or, perforating it, runs with the cephalic vein immediately under the skin."

PLATE XVIII.

The inferior mesenteric artery is here shown.

Nos. 1, 1. The transverse part of the colon drawn upwards on a level with the margin of the ribs; the mesentery with the superior mesenteric artery is drawn over to the right side. 2, 2. The transverse meso-colon. 3, 3, 3. The pancreas. 4. The descending part of the duodenum. 5, 5, 5, 5, 5. Convolutions of the small intestine. 6, 6. The left or descending part of the colon. 7, 7. The left meso-colon. 8. The flexure of the colon. 9. The commencement of the rectum.

A, A. The aorta, lying upon the front of the spine. a. The trunk of the inferior mesenteric artery. b. The left colic artery (arteria colica sinistra, or ramus colicus sinister). c. The ascending branch of the left colic artery passing upwards to anastomose with the middle colic artery. d. Its descending branch, which turns down to anastomose with the sigmoid branch. e. The continuation of the inferior mesenteric artery; it gives off, f, the sigmoid branch (arteria sigmoidea), which goes to the flexure of the colon, and, g, the superior hæmorrhoidal branch (arteria hæmorrhoidalis superior), which passes down behind the rectum.

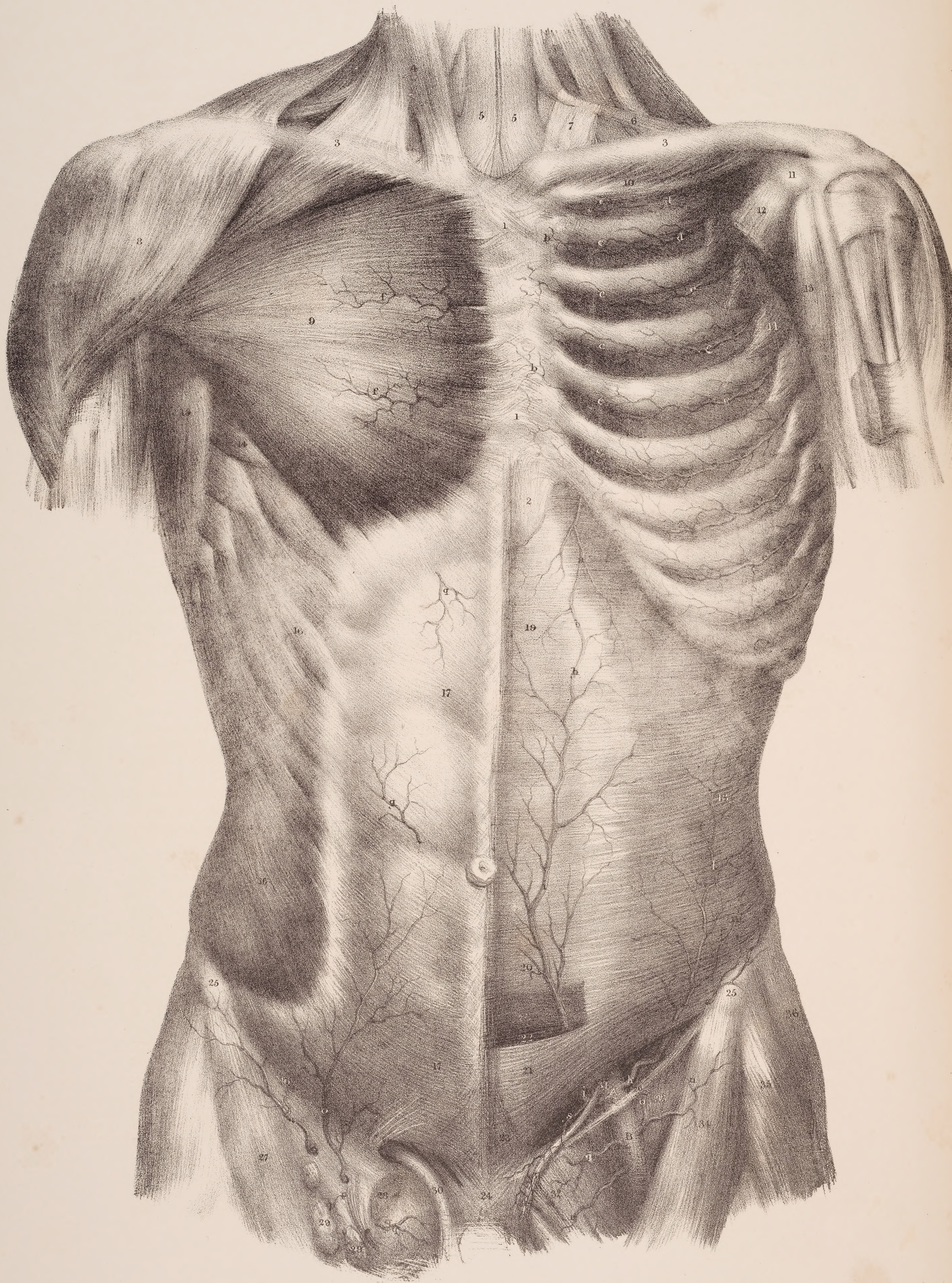


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The latter case must be of rare occurrence. In some instances the radial artery, instead of continuing its course to the lower part of the radius, inclines outwards and backwards a little below the middle of the fore-arm, and so descends along its outer border, superficial to the extensor tendons. When the radial artery arises thus high, and runs superficial, the external or radial recurrent is a branch of the brachial artery, or more rarely of the ulnar.

When the origin of the ulnar artery takes place high in the arm, it lies beneath the fascia as it descends, and runs superficial to the flexor muscles. In one instance of a high division, Tiedemann observed a cross branch connecting the ulnar and brachial. In a few cases an anomalous branch has been observed to pass down from the brachial and end in the radial, or in the brachial itself. This appears to be but a minor degree of that division, and subsequent re-union, instances of which in the brachial and femoral arteries have been above noticed.

The inter-osseous artery, in two or three cases (at least there are no more recorded), arose from the brachial about the middle of the arm. Its position was internal, and posterior to the main artery; and on reaching the bend of the elbow, passed deeply between the muscles, and assumed the usual position of the vessel. A superficial anterior inter-osseous artery sometimes exists, which arises a little below the elbow-joint, and takes the course of the median nerve to the palm of the hand, where it terminates by inosculation in the palmar arch.

The brachial artery, when arrived opposite the insertion of the brachialis anticus muscle, divides into its ulnar and radial branches.

The Ulnar artery (plate IX. fig. 2, C, C; arteria ulnaris) inclines, in rather a curved direction, downwards and inwards, passing under cover of the superficial muscles which arise from the inner condyle, viz. the pronator teres, flexor carpi radialis, palmaris longus, and flexor sublimis, until it

PLATE XIX.

The arteries supplying the anterior parietes of the chest and abdomen, and the superficial blood-vessels in the groin, are here shown.

No. 1. The sternum covered by the tendinous interlacements of the great pectoral muscle and anterior sterno-costal ligaments. 2. The ensiform cartilage. 3, 3. The clavicles. 4. The sterno-mastoid muscle. 5, 5. The sterno-hyoid muscles. 6. The inferior belly of the omo-hyoid muscle. 7. A process of the deep fascia of the neck, which holds down the tendon of the omo-hyoid muscle, permitting the play of the tendon through it as through a pulley. 8. The deltoid muscle. 9. The great pectoral muscle. 10. The sub-clavius muscle. 11. The coracoid process. 12. The lesser pectoral muscle divided. 13. The coracobrachialis muscle. 14, 14. Digitations of the serratus magnus muscle. 15. Latissimus dorsi muscle. 16, 16. The external oblique muscle of the abdomen. 17, 17. The aponeurosis of the external oblique muscle proceeding to its attachment in the linea alba. 18. The transversalis muscle of the abdomen; the external oblique, internal oblique, and rectus muscles having been removed. 19. The aponeurosis of the transversalis muscle forming the posterior layer of the sheath of the rectus muscle. 20. The inferior part of the sheath of the rectus, becoming thin before it is entirely lost. 21. The lower part of the aponeurosis of the transversalis muscle passing in front of the rectus muscle. 22. The rectus muscle cut across to display the epigastric artery. 23. The pyramidalis muscle seen through the aponeurosis of the transversalis muscle. 24. The interlacement of the tendinous fibres of the external oblique muscle, in front of the symphysis of the pubis. 25, 25. The anterior superior spine of the ilium. 26, 26. Poupart's ligament. 27. The form of the sartorius muscle apparent through the fascia lata. 28. The saphenous opening in the fascia lata. 29. Absorbent glands resting on the fascia lata. 30. The spermatic cord, issuing from the external ring in the aponeurosis of the external oblique muscle. 31, 31. The vas deferens crossing the epigastric artery as it curves inwards to the side of the bladder. 32. The pectineus muscle. 33. The iliacus muscle. 34. The sartorius muscle. 35. The anterior border of the glutæus medius muscle. 36. The tensor vaginæ femoris muscle.

a. The internal mammary artery. b, b. Superficial branches of the internal mammary supplying the front of the sternum. c, c. Intercostal branches of the internal mammary. d, d. Intercostal branches from the superior intercostal artery. e, e. Intercostal arteries from the aorta, inosculating with the anterior intercostal branches of the internal mammary. f, f. External mammary branches from the internal mammary artery.

A. The external iliac artery, giving off the epigastric and circumflex ilii arteries. B. The femoral artery.

g, g. Small cutaneous branches from the epigastric artery. h. Inosculation of the internal mammary artery with the epigastric. i, i. The epigastric artery. k. The circumflex ilii artery at its origin from the trunk of the external iliac. l. The continuation of the artery upon the transversalis muscle. m. The branch which follows the curve of the crest of the ilium. n, n. The superficial circumflex ilii artery from the femoral; on the right side it is seen piercing the fascia lata, and running outwards to the crest of the ilium. o, o. The superficial epigastric artery; on the left side it is divided immediately after its origin. p. A small branch to the inguinal glands. q, q. Superficial external pudic arteries. r. Deep external pudic artery. s. The deferential artery from the epigastric, ramifying along the course of the vas deferens.

reaches the flexor carpi ulnaris. About the same point, that is, at the junction of the upper with the middle third of the fore-arm, the artery comes into contact with the ulnar nerve, which had previously been separated from it by a considerable interval, having lain behind the inner condyle, but here approaches it, lying to its ulnar side. Thus placed, they both descend towards the inner border of the palm of the hand. In the first part of its course the artery is covered by the muscles above enumerated; in the middle of the arm it is overlapped by the flexor carpi ulnaris; and, in the lower, it runs parallel and in close relation with the outer border of its tendon. In this part of its course the vessel is covered only by the common integuments, the fascia of the arm and a thin layer, by which it is connected to the muscles behind it. For two-thirds of its extent it lies on the flexor profundus muscle; in the rest, on the pronator quadratus and annular ligament. It is accompanied, in its entire extent, by two veins, which lie one on each side. At its origin the artery is in close relation with the median nerve, from which, however, it is soon separated by the origin of the pronator teres from the coronoid process of the ulna; inclining inwards, it approaches the ulnar nerve, and by it is accompanied in the lower two-thirds of its course,—the nerve lying on the ulnar side of the artery.

Palmar arch (superficial; plate IX. fig. 1, p, p).—The ulnar artery, guided as it were by the tendon of the flexor ulnaris muscle, reaches the radial border of the pisiform bone, where, accompanied by the nerve, it passes over the cutaneous surface of the annular ligament of the wrist. At this point the artery begins at once to change its direction, by running outwards and forwards, across the palm of the hand; and on arriving about midway between the flexure formed by the bend of the first joint of the thumb and that of the fore-finger, it terminates by inosculating with a branch (*superficialis volæ*) sent forwards by the radial artery, to unite with it. The vessel thus describes a curve, whose convexity looks forwards. This curved part of the artery is called the *superficial palmar arch* (arcus volæ superficialis), to distinguish it from the deep-seated one formed by the radial artery. It rests on the annular ligament of the wrist at its commencement, and afterwards on the tendons of the flexor sublimis; and is covered, for a short way, by the palmaris brevis, and afterwards by the palmar fascia and integument. The vessel, in the palm, is usually somewhat tortuous; and presents not a few varieties in its course and mode of termination.

The branches of the ulnar artery in the fore-arm are the following:—

The anterior Recurrent branch (plate IX. fig. 2, p; ramus recurrens anterior) arches inwards from the ulnar artery, near its origin, running on the brachialis anticus muscle, and covered by the pronator teres, to both of which it sends ramusculi. On reaching the inner condyle, it anastomoses with the ramus profundus inferior and anastomoticus, derived from the brachial artery.

The posterior Recurrent branch (plate X. fig. 2, d; r. recurrens posterior) is larger than the preceding, and comes off lower down; but not unfrequently they both arise by a small common trunk. It runs backwards somewhat, and ascends upon the posterior aspect of the inner condyle; and in the interval between that process and the olecranon, anastomoses with the r. profundus inferior, some of its branches extending outwards, so as to communicate with those of the r. profundus superior and recurrens inter-osseus.

The Inter-osseous branch (plate IX. fig. 2, D, D; r. inter-osseus, communis) is of considerable size, and is sometimes called the common inter-osseous artery, from the circumstance of its dividing into two vessels bearing that name, which lie on the opposite surfaces of the inter-osseous ligament or membrane. This vessel inclines somewhat backwards after its origin, to reach the upper border of the inter-osseous ligament, where its division takes place.

The anterior Inter-osseous branch (plate IX. fig. 2, D; plate X. fig. 3, g, h: r. inter-osseus anterior) proceeds downwards, lying on the anterior surface of the interosseous ligament, and is accompanied by the inter-osseous branch of the median nerve, and overlapped by the contiguous borders of the flexor profundus and flexor longus pollicis. Thus placed, it gives off some muscular branches, and the two nutritious arteries (r. medullares) to the radius and ulna. These incline to each side and enter the oblique foramina in the bones just mentioned, to be distributed to the medullary membranes in their interior. The artery continues its course directly downwards until it reaches the upper border of the pronator quadratus muscle, where it gives off some small branches to supply that muscle and ramify upon the carpus, after which it passes from before backwards, through an opening in the inter-osseous ligament; and, on reaching its dorsal surface, proceeds along the back of the carpus, where it maintains communications with the posterior carpal branches of the radial and ulnar arteries.

The posterior Inter-osseous branch (plate X. figs. 2 and 3, e; r. inter-osseus posterior) passes back-

wards, through the interval left between the oblique ligament and the upper border of the inter-osseous ligament. Continuing its course downwards, along the arm, under cover of the extensor muscles, it gives several branches to them, and reaches the carpus considerably diminished in size, where its terminal branches anastomose with the perforating or terminal branches of the anterior inter-osseous artery, and with the carpal branches of the radial and ulnar arteries. In addition to numerous muscular branches, which require no special notice, this artery, as soon as it reaches the posterior surface of the ligament, gives off a recurrent branch (*r. recurrens inter-osseus posterior*; plate X. fig. 1, c; fig. 2, f; fig. 3, d,) which is nearly as large as the continuation of the vessel. This branch passes directly upwards, covered by the supinator brevis and anconeus, to reach the interval between the olecranon and external condyle, where it divides into several ramusculi, that anastomose with the terminal branches of the *r. profundus superior* and inferior, as well as of the posterior ulnar recurrens.

Muscular branches (*r. musculares*).—Several branches are distributed to the muscles by the ulnar artery in its course along the arm.

The dorsal Carpal branch (plate X. fig. 1, h; fig. 3, p: *r. carpi dorsalis*) is a branch of variable size, which inclines backwards from the ulnar artery a little before it reaches the pisiform bone. It winds back under the tendon of the flexor carpi ulnaris, and reaches the dorsal surface of the carpus; there it gives some ramuli which anastomose with similar offsets from the metacarpal branch of the radial artery, after which it runs along the metacarpal bone of the little finger, and forms its dorsal branch. From the arch of anastomosis, just referred to, the second and third dorsal inter-osseous branches are derived.

The palmar Carpal branch (*r. carpi palmaris*) is a very small twig, which runs on the anterior surface of the carpus, and anastomoses with a similar offset from the radial artery.

Branches given off by the palmar arch:

The communicating branch (plate IX. fig. 2, r; *r. communicans*) arises a little beyond the pisiform bone, and sinks deeply between the flexor brevis and the abductor of the little finger; it inosculates with the termination of the radial artery, and thereby completes the deep palmar arch.

Palmar branches (*ramuli palmares*).—From the concavity and dorsal surface of the palmar arch, small branches are given to the parts in the palm of the hand.

The digital branches (plate IX. fig. 1, t, u; *r. digitales*), four in number, proceed forwards from the convexity of the palmar arch, to supply the fingers. The *first* branch inclines inwards to the ulnar border of the hand, and after giving ramusculi to the small muscles of the little finger, runs along the inner margin of its phalanges. The *second* runs along the fourth metacarpal space, and at the root of the fingers divides into two ramusculi, which proceed along the contiguous borders of the ring and little fingers. The *third* is similarly disposed of to the ring and middle fingers, and the *fourth* to the latter and the index;—the radial side of the index finger and the thumb are supplied from the radial artery. Each pair of collateral branches, on arriving at about the middle of the last phalanx of the finger, converge and form an arch, from the convexity of which small ramusculi run forwards to its termination.

The radial artery (plate IX. figs. 1 and 2, B; plate X. figs. 1 and 3, i: *arteria radialis*), in direction though not in size, appears to be the continuation of the brachial. Its direction is from the point of division above indicated towards the styloid process of the radius, lying obliquely along the anterior aspect of the fore-arm, its course being indicated by a line drawn from the middle of the bend of the elbow to the narrow interval between the trapezium bone and the tendons of the extensors of the thumb. These can be readily felt towards the outer border of the wrist. The artery is covered by the fascia of the arm and integument, and for some way is overlapped by the fleshy part of the supinator longus, which must be drawn aside in order to expose it. It is at first supported by the branches of the musculo-spiral nerve, and some cellular tissue, which separate it from the supinator radii brevis muscle; it then passes over the insertion of the pronator teres and the radial origin of the flexor sublimis; after which, it lies on the flexor pollicis longus and pronator quadratus, until it reaches the end of the radius. To its inner side lies the pronator teres in the upper part of its course, and the flexor carpi radialis in the rest; its outer side being in apposition with the supinator longus all the way down. Two venæ comites run parallel with the artery. The radial branch of the musculo-spiral nerve lies to its radial side during the middle third of its extent; but above that part the nerve is separated from it by a considerable interval, and lower down it turns backwards, to reach the dorsal aspect of the arm, and loses all anatomical relation to it. Opposite the end of the radius the artery inclines outwards, passing between its styloid process and the trapezium, and beneath the two first extensors of the thumb.

It then runs forwards for a short way (lying in the angular interval between the tendons of the two first extensors of the thumb and that of the third), to gain the angle between the two first metacarpal bones, and makes its final turn into the palm of the hand, by passing between the heads of the abductor indicis muscle.

Palmar arch (deep-seated; plate IX. fig. 2, r, r).—The terminal part of the artery (*arcus volæ profundus*) runs transversely across the palm of the hand, lying on the heads of the inter-osseous muscles (to which it gives branches) and the carpal extremities of the metacarpal bones, and opposite the fourth bone of that name inosculates, with the communicating branch from the ulnar artery, which completes the deep palmar arch. This differs from the superficial arch, not only in being more deeply seated (being covered by all the flexor tendons), but also in retaining its size almost undiminished, and lying near the carpus.

The radial artery gives off the following branches:

The Recurrent branch (plate IX. 1; plate X. figs. 1, d, 3, b; ramus recurrens) arches upwards from the artery soon after its origin, running between the branches of the spiral nerve. It lies on the supinator brevis, covered by the supinator longus; and opposite the external condyle anastomoses with the terminal branches of the r. profundus superior, having in its course given ramuli to the extensor and supinator muscles.

Muscular branches (ramuli musculares).—Several unnamed branches are given to the muscles on the fore part of the arm.

The superficial Palmar branch (plate IX. fig. 1, o; fig. 2, n: r. superficialis volæ) proceeds directly forwards from the artery, where it is about to turn towards the back of the hand, and seems like the proper continuation of that vessel in direction, though not in size, as it is usually small and tapering. In this respect, however, it is subject to many varieties. This branch runs over the small muscles of the thumb at their origin, lying upon the annular ligament, to which it is bound down by a thin process of fascia, and terminates by inosculating with the radial extremity of the superficial palmar arch, which it thus completes.

The posterior Carpal branch (plate X. figs. 1 and 3, k; r. carpi posterior, r. dorsalis carpi radialis) arises close by the tendons of the radial extensor muscles, beneath which it runs upon the dorsal surface of the carpus, to anastomose with a similar branch, proceeding from the ulnar artery.

The anterior Carpal branch (r. carpi anterior).—A small branch will be found also on the anterior surface of the carpus, arising from the radial artery somewhat higher up. It is usually called *ramus anterior carpi radialis*, to distinguish it from a similar branch of the ulnar artery, with which it anastomoses.

Metacarpal branch (plate X. fig. 1, o; figs. 3, s: r. metacarpi).—When under the extensors of the thumb, a branch goes off obliquely forwards as if to gain the interval between the second and third metacarpal bones. It gives from its ulnar side one or two ramuli, which join with small branches from the posterior carpal branch of the ulnar artery, and form an arch or net-work of vessels upon the carpus. The continuation of the metacarpal branch runs upon the second dorsal inter-osseous

PLATE XX.

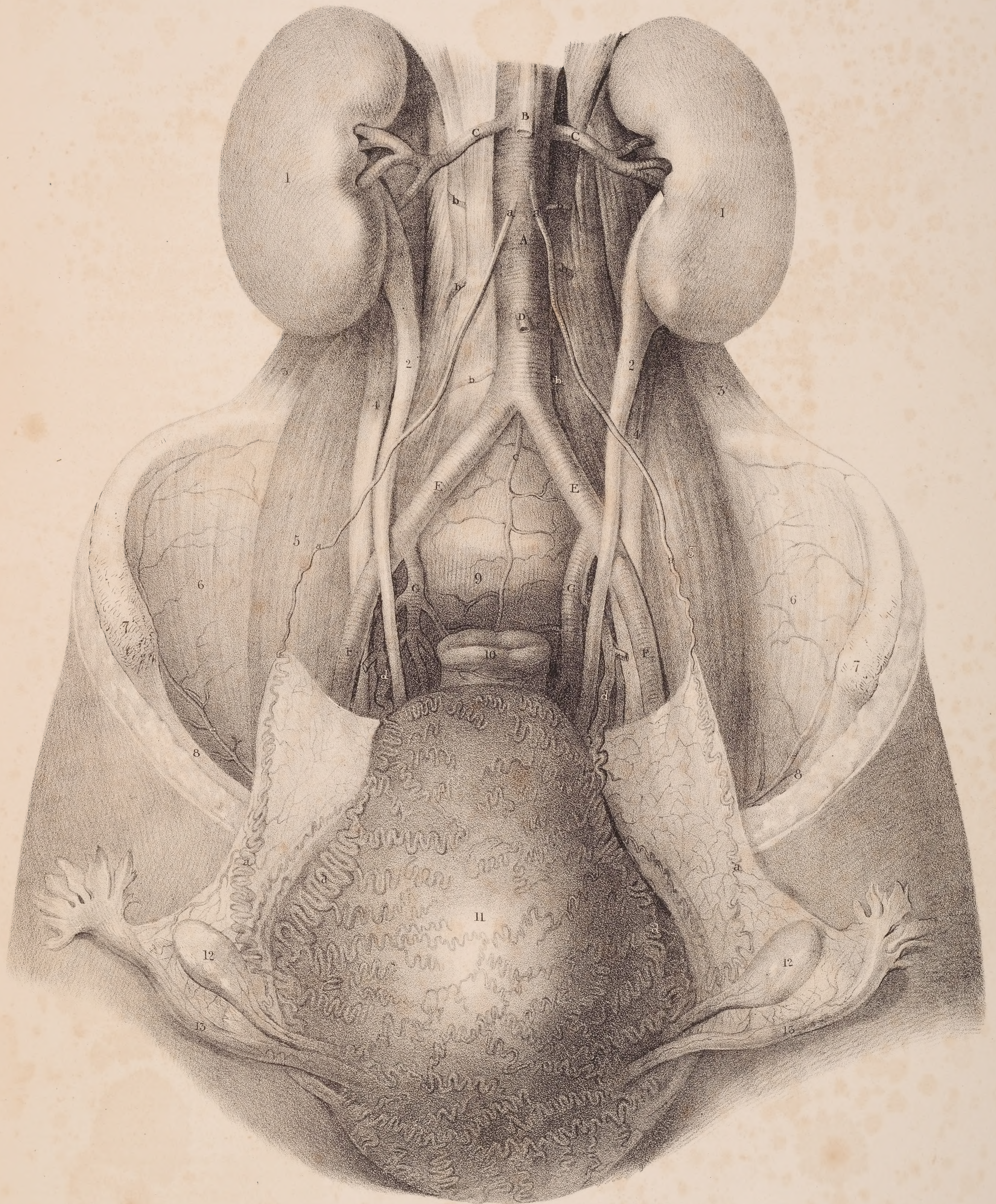
The arteries supplying the uterus, in a woman who died six days after delivery; showing their enlargement and tortuous distribution.

Nos. 1, 1. The kidneys. 2, 2. The ureters. 3, 3. The quadratus lumborum muscles. 4, 4. The small psoas muscles. 5, 5. The great psoas muscles. 6, 6. The iliacus muscles. 7, 7. The anterior superior spinous process of the ilium on each side. 8, 8. Poupart's ligament at each side. 9. The prominence of the sacrum. 10. The rectum cut across. 11. The body of the uterus, displaying its enlarged form after recent delivery. 12, 12. The ovaries connected by their ligaments to the upper angles of the uterus. 13, 13. The Fallopian tubes terminating in the fimbriated extremities.

A. The abdominal aorta. B. The divided trunk of the superior mesenteric artery. C, C. The renal arteries. D. The divided inferior mesenteric artery. E, E. The common iliac arteries. F, F. The external iliac arteries. G, G. The internal iliac arteries.

a, a. The spermatic arteries arising from the main trunk of the aorta, enlarged and tortuous in their course through the broad ligaments of the uterus. They are distributed to the ovaries and sides of the uterus, communicating freely with the uterine arteries. b, b. Lumbar arteries. c. The middle sacral artery. d, d. The uterine arteries, arising from the internal iliacs, and ramifying in a tortuous course upon the sides and fundus of the uterus. e, e. The circumflex ilii branches of the external iliac arteries, ramifying round the crest of the ilium, and inosculating with branches from the ilio-lumbar arteries.

Plate 20.



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Fig. 1

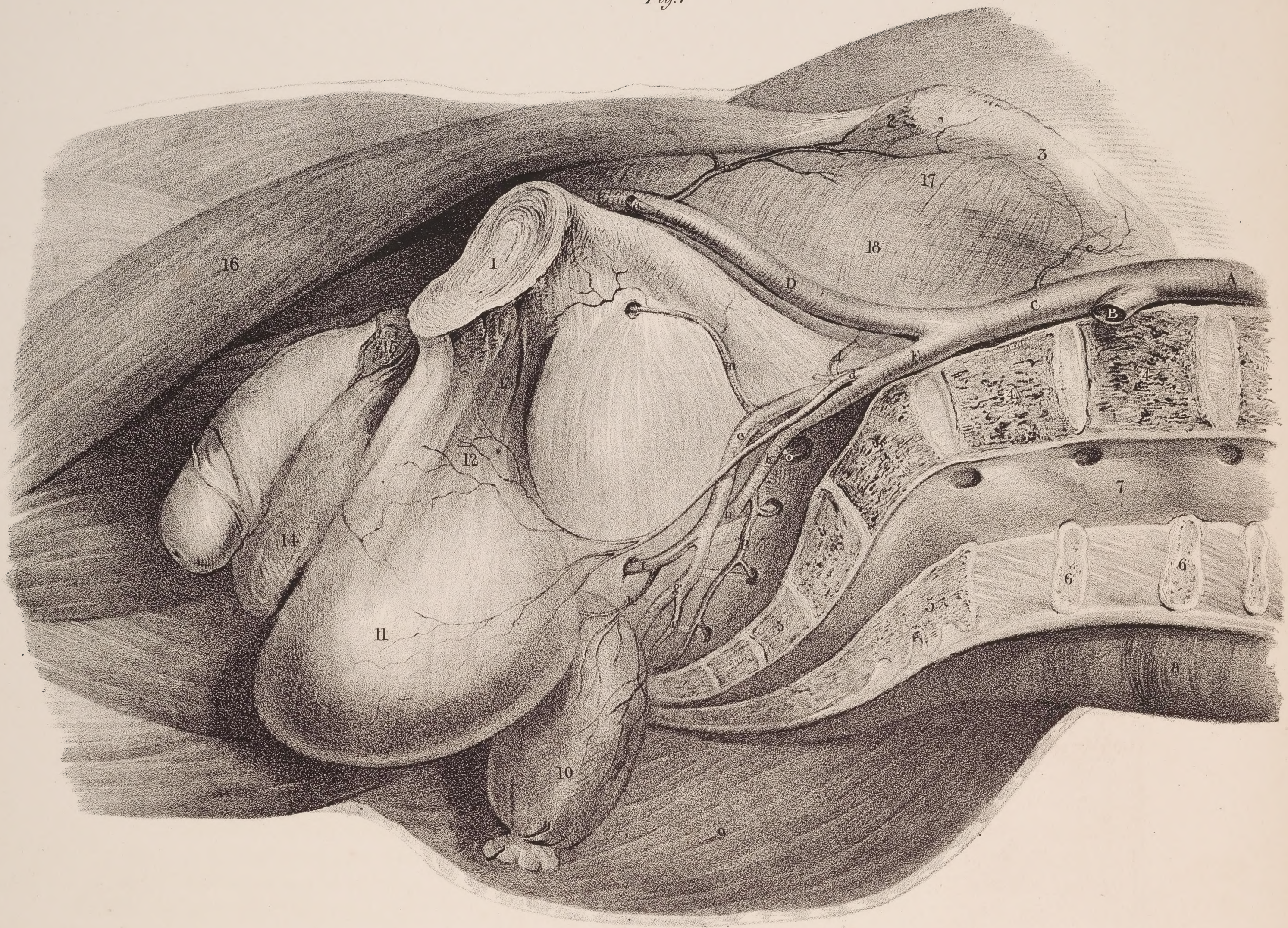
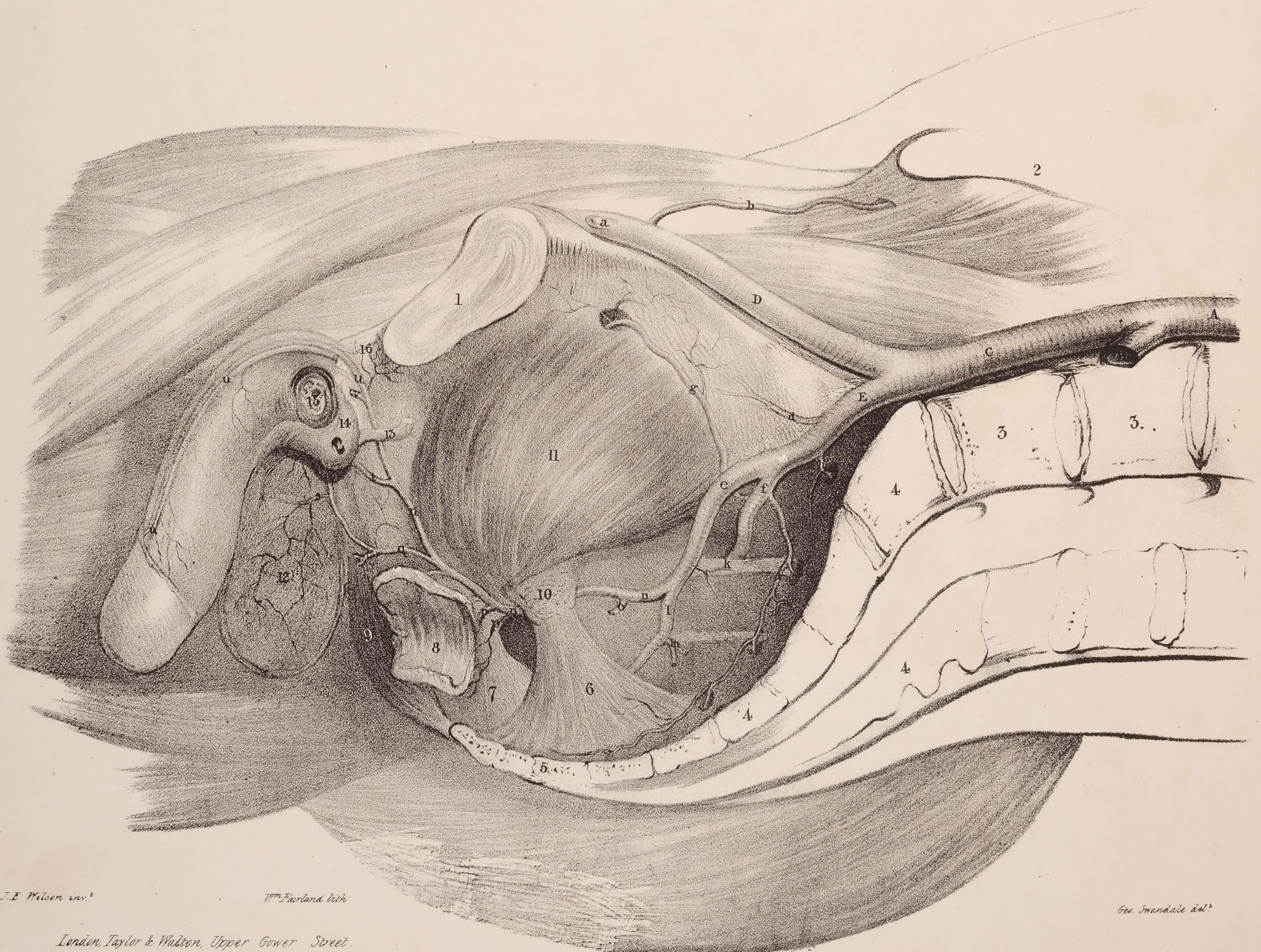


Fig. 2.



muscle; at the cleft between the fingers it gives off ramuli to the dorsal surface of the middle and fore-finger and communicates with the palmar digital branch at its point of division. This part of the artery is sometimes called the first dorsal inter-osseous branch, the second and third being derived from the arch of arteries above noticed.

The Dorsal arteries of the thumb (plate X. fig. 1, l; fig. 3, l, m : r. dorsales pollicis) are two, which sometimes arise separately, at others by a common trunk, which divides into two ramusculi that run along upon the dorsal aspect of the bones of the thumb, one at its radial, the other at its ulnar border.

The Dorsal branch of the index finger (r. dorsalis indicis) arises lower down than the preceding, and after sending ramusculi to the abductor indicis, runs along the dorsal surface of the index finger. Its size is very variable.

The Digits-palmar branch of the thumb (plate IX. fig. 2, o; plate X. fig. 1, m; fig. 3, n : r. princeps pollicis) commences where the artery is about to turn across the palm of the hand, and after proceeding forwards between the abductor indicis and adductor pollicis, divides, near the extremity of the first metacarpal bone, into two ramusculi, which run along the borders of the phalanges of the thumb at its palmar aspect. These form its collateral branches, and unite by anastomosing upon its second phalanx, in the same way as those of the other fingers, derived from the superficial palmar arch.

The Digits-radial branch of the fore-finger (plate IX. fig. 1, r; fig. 2, s; plate X. fig. 1, n; fig. 3, o : r. radialis indicis).—Close to the preceding, a branch arises, variable in size, but very regular in its course. It runs along the external border of the index finger, and on its last phalanx anastomoses with the corresponding collateral branch derived from the superficial palmar arch.

Recurrent branches (ramuli recurrentes).—From the concavity of the deep palmar arch, ramuli proceed backwards, and communicate with the carpal arteries.

PLATE XXI.

A lateral view of the arteries of the pelvis in the male subject. The pelvis is divided by a vertical incision carried through the symphysis pubis; the middle of the lumbar vertebræ and sacrum. The viscera are removed from their natural position and drawn downwards.

Fig. 1. No. 1. Symphysis pubis. 2. The anterior superior spine of the ilium. 3. The crest of the ilium. 4, 4. The divided surface of the two last lumbar vertebræ. 5, 5. The divided surface of the sacrum. 6, 6. The divided spinous processes of the two last lumbar vertebræ. 7. The termination of the spinal canal. 8. The erector spinæ muscle of the right side. 9. The glutæus maximus muscle. 10. The rectum, and 11, the bladder drawn down from the cavity of the pelvis. 12. A slight elevation produced by the prostate gland. 13. The anterior ligaments of the bladder. 14. The scrotum. 15. The corpus cavernosum of the left side, divided. 16. The sartorius muscle. 17, 18. The iliacus and psoas muscles concealed by the iliac fascia.

A. The aorta. B. The left common iliac artery, divided. C. The right common iliac. D. The external iliac. E. The femoral artery. F. The internal iliac.

a. The epigastric artery, cut off. b. The circumflex ilii artery inosculating with, c, the terminal branches of the ilio-lumbar artery. d. The umbilical artery giving branches (superior vesical) to the side of the bladder and prostate gland. e. The anterior branch of the internal iliac artery dividing into, f, the internal pudic, and, g, the sciatic arteries. h. The middle hæmorrhoidal artery, giving off inferior vesical branches. i. An hæmorrhoidal branch from the sciatic artery. k. The posterior branch of the internal iliac artery. l. The ilio-lumbar artery. m. The obturator artery. n. The glutæal artery. o. A small spinal artery, passing into the first sacral foramen. p. The lateral sacral artery.

Fig. 2. The viscera are here removed, and the fascia dissected off from the interior of the pelvis, to show the course and distribution of the internal pudic artery to its termination.

No. 1. The symphysis pubis. 2. Crest of the ilium. 3, 3. Bodies of the fourth and fifth lumbar vertebræ. 4, 4. The sacrum. 5. The coccyx. 6. The anterior sacro-sciatic ligament. 7. The posterior sacro-sciatic ligament. 8. A portion of the extremity of the rectum. 9. The right half of the sphincter ani muscle. 10. The spine of the ischium. 11. The obturator internus muscle. 12. The septum scroti. 13. The membranous part of the urethra. 14. The bulbous portion of the corpus spongiosum. 15. A section of the left corpus cavernosum. 16. The suspensory ligament of the penis.

A. The aorta. B. The left common iliac artery. C. The right common iliac. D. The external iliac. E. The internal iliac.

a. The epigastric artery divided. b. The circumflex ilii artery. d. The umbilical trunk divided. e. The anterior branch of the internal iliac. f. The posterior branch. g. The obturator artery. h. A small sacral artery, sending branches into the first and second sacral foramina. i. The lateral sacral artery. k. The glutæal artery passing out of the pelvis immediately above the first sacral nerve. l. The sciatic artery, giving off, m, a visceral branch. n, n. The internal pudic artery, giving off, o, the middle hæmorrhoidal artery. p, p. External hæmorrhoidal arteries. q. The superficial perinæal artery, giving off, r, the transversus perinæi branch. s. A branch of the superficial artery ramifying upon the septum scroti. t. The artery of the bulb (r. corporis bulbosi); that of the left side is seen divided just at its entrance into the bulb. u, u. The dorsalis penis artery. v. The artery of the corpus cavernosum.

Inter-osseous branches (plate IX. fig. 2, t ; r. inter-ossei).—From the convexity of the arch others run forwards along the metacarpal spaces, supplying the inter-osseous muscles, and anastomosing with the digital branches of the ulnar artery.

Perforating branches (plate X. fig. 3, r ; r. perforantes).—These are small ramuli, usually three in number, which pass backwards through the metacarpal spaces at their superior extremities, and inosculate with the dorsal inter-osseous branches.

Varieties.—The distribution of the arteries in the hand presents, in very many instances, deviations from the arrangement here indicated. We occasionally find the superficial palmar arch formed by the ulnar artery alone, the superficialis volæ branch being too small to extend farther than the muscles of the thumb, upon which it is expended. In such cases the digital branches of the thumb, as well as those of the other fingers, are derived from the ulnar artery, which is necessarily a little larger than usual.

In other instances the ulnar artery forms but half the palmar arch. In these the superficialis volæ is larger than usual, and, on reaching the palm, inclines inwards, so as to meet the ulnar artery about the middle line. The digital branches of the fingers are derived from the arch thus formed and those of the thumb generally from the superficialis volæ by means of a short vessel which it gives off previously to its junction.

The ulnar artery is sometimes found to incline very little towards the radial side of the hand, and to supply no more than the little finger, the ring finger, and one side of the middle finger ; the rest of the digital branches being derived from the superficialis volæ ; here there is in strictness no palmar arch, and, there is no direct connexion between the superficialis volæ and the ulnar artery. The ulnar artery has been observed to incline obliquely across the palm, being directed from the pisiform bone to the root of the fore-finger, supplying the usual number of digital branches. In some of these cases a connexion is formed between it and the superficialis volæ, if the latter be large, by a small transverse branch passing from the one to the other a little before the annular ligament.

The ulnar artery on reaching the palm has been found so diminutive as to terminate in a few offsets upon the muscles of the little finger, being incapable of supplying any digital branches. It may perhaps give one branch to the inner border of the little finger. Here all the collateral branches of the fingers are derived from the deep palmar arch of the radial artery. The inter-osseous branches of the latter, on reaching the cleft of the fingers, divide and run along their margins, occupying the position of the branches ordinarily supplied by the superficial palmar arch.

A superficial inter-osseous artery has been observed to run along the fore-arm in the course of the median nerve, and after passing into the palm of the hand, to join the palmar arch formed in the usual way. But, in some rare instances of this sort, the ulnar artery was found smaller than it generally is, and the thumb, and the fore-finger, and one side of the middle finger, were supplied by the inter-osseous branch. The ulnar artery passed obliquely forwards and gave off the remaining digital branches.

The deep palmar arch varies much in its size. The radial artery may in this part be larger than usual, and may give off, as above stated, the collateral branches to the fingers, or it may be smaller, and form only half the deep arch, the rest being made up by the communicating branch of the ulnar artery.

Finally, the greater part of the arch may be formed by the ulnar artery, the radial being so small when it reaches the palm of the hand that it opens into the ulnar at the root of the thumb. Here the size of the vessel which forms the arch diminishes as it runs from the ulnar towards the radial side of the metacarpus.

The Thoracic aorta (plate XIII. D ; *its straight portion*).—The aorta having completed its curve or arch at the lower border of the third dorsal vertebra, descends along the spine to the fourth lumbar vertebra, where it divides into the common iliac arteries. Its direction is not vertically downwards, for as its course is influenced by the spine, upon which it rests, it is necessarily concave forwards in the dorsal region, and convex forwards in the lumbar. Again, its commencement is at the left side of the spine, its termination also inclines a little to the left, whilst about the last dorsal vertebra it is nearly upon the median line. From this arises another curve, the convexity of which is to the right side, and the concavity to the left. Within the thorax it diminishes little in size ; in the abdomen the diminution is considerable, in consequence of its giving off large branches soon after its entrance into that cavity.

The thoracic aorta lies in the posterior mediastinum, being before the spine, and behind the root of the left lung and the pericardium ; its left side is in contact with the corresponding pleura, the

right with the vena azygos major, the thoracic duct, and œsophagus. The latter tube, however, as it descends, inclines in front of the artery, and near the diaphragm gets to its left side.

The branches which it gives are numerous but small.

The Pericardiac branches (a. pericardiacæ) are some very small and irregular vessels which pass forwards and ramify on the pericardium.

The Bronchial branches (plate XIII. d, e; a. bronchiales) are the proper nutritious arteries of the substance of the lung; they accompany the bronchial tubes in their ramifications through the organ. They vary much in their mode of origin, and also in their number; in some instances there being two, in others three, four, or even five. Thus, two small vessels arise from the aorta, about an inch below the arch, which diverge, inclining forwards and outwards, each being directed to the corresponding bronchus, whose course it takes, dividing and subdividing with the minuter bronchi into the substance of the lung. These are the *superior* bronchial arteries; they occasionally issue from a small common trunk. Lower down, two others (a. bronchiales inferiores) come off, which apply themselves to the bronchi and take a similar course. The right bronchial artery often arises from the first aortic intercostal. The left has been seen to arise from the subclavian, and, in a few rare instances, from the inferior thyroid.

The Œsophageal branches (plate XIII. f, f; a. œsophageales) are also variable in size and number; there are usually four or five, which arise from the fore part or right side of the aorta, and run obliquely downwards upon the œsophagus, freely supplying its substance. The lower branches of these vessels anastomose with the ascending offsets of the coronary artery of the stomach, whilst the upper ones communicate in a similar way with branches of the inferior thyroid.

The Intercostal arteries (plate XIII. g, h; plate XIX. e, e; a. intercostales, inferiores) arise from the posterior part of the aorta, and run at first outwards and upwards upon the bodies of the vertebræ, after which they lie along the intercostal spaces. Their number varies; there are usually eight or nine at the right side, for the two or three first intercostal spaces are supplied by the superior intercostal artery, derived from the subclavian; on the left side there are generally ten. Owing to the position of the aorta with regard to the spine, the right aortic intercostals are a little longer than the left. As these vessels pass outwards, they are covered by the pleura, and crossed by the sympathetic nerve; those of the right side also pass behind the œsophagus, the thoracic duct, and the vena azygos major. When arrived in the intercostal space, the corresponding vein being above it and the nerve below it, the artery gives off its posterior branch (plate XIII. i, i), which passes directly backwards, and is ultimately distributed to the muscles of the back which are lodged in the vertebral groove; previously to which, it gives ramusculi to the body of the vertebra upon which it passed, and also one which enters the intervertebral foramen and ramifies upon the membranes of the spinal cord. The continuation of the vessel is placed at first between the pleura and the external intercostal muscle, and then between the two planes of muscles of that name. It divides into two branches, which diverge at an acute angle and then run along parallel to one another, taking the course of the margins of the ribs between which they lie. The inferior or smaller branch inclines downward, and approaches the border of the rib which lies below its intercostal space, and after giving small twigs to the bone and the intercostal muscles, anastomoses with some of the superficial vessels. The superior or larger branch inclines towards the border of the rib which lies above its intercostal space, and, after giving branches to the intercostal muscles and communicating with the preceding branch, anastomoses with the anterior intercostal branches derived from the internal mammary artery, and with the thoracic branches of the axillary artery. The first aortic intercostal artery has an anastomosis with the vessel of that name, which comes from the subclavian artery, and the three last are prolonged amongst the abdominal muscles, where they communicate with the epigastric artery in front, the phrenic internally, and the lumbar branches of the abdominal aorta inferiorly.

The Abdominal aorta (plate XIV. A).—The aorta, after having passed between the crura of the diaphragm, rests on the bodies of the lumbar vertebræ as far as the fourth, where its division takes place. Its anterior surface is successively in apposition with the liver, the pancreas, duodenum, and mesentery. The vena cava accompanies it, lying at its right side, and it is surrounded by a mesh of nerves derived from the sympathetic.

The branches of the abdominal aorta are divided into two sets—1. Those which arise from its fore part and singly, viz. the cœliac, and the superior and inferior mesenteric. 2. Those which pass off in pairs, viz. the phrenic, capsular, renal, spermatic, and lumbar.

The Cœliac artery or Axis (plates XIV. and XV. B; arteria cœliaca) arises from the aorta whilst between the crura of the diaphragm, and as soon as it becomes apparent in the cavity of the abdomen. In the erect position of the body its direction is nearly horizontally forwards, but it is not more than

half an inch long. It is concealed by the small omentum, and lies close to the left side of the lobulus Spigelii and above the pancreas, the two semi-lunar ganglia being in apposition with it on either side. It gives off three remarkable branches; viz. the coronary artery of the stomach, the hepatic, and splenic.

1. *The Coronary artery of the stomach* (plate XIV. c; plate XV. C; plate XVI. fig. 1, C, fig. 2, a: a. coronaria ventriculi), the smallest of the three, inclines upwards, and to the left side, to reach the cardiac orifice of the stomach. At this point some ramuli are sent upwards on the œsophagus, which communicate with the aortic œsophagean branches; others pass before and behind the cardiac extremity of the stomach, which they coil round. The continuation of the vessel inclines from left to right along the upper curvature of the stomach, gives branches to its coats, and inosculates with the pyloric branch of the hepatic artery.

2. *The Hepatic artery* (plate XIV. d; plates XV. and XVI. D: a. hepatica), intermediate in size, at least in the adult, between the coronary and the splenic, passes upwards, and to the right side, to reach the transverse fissure of the liver, in which course it lies in front of the vena portæ and to the left of the hepatic duct. Previously to reaching the liver, it gives the following branches:—

The Pyloric branch (plate XV. e; plate XVI. d: ramus pyloricus) descends to reach the pyloric end of the stomach, and then turns along its upper curvature, about the middle of which it inosculates with the coronary artery: it is sometimes a branch of the following:—

The Gastro-duodenal artery (plate XV. o; plate XVI. fig. 1, g: r. gastro-duodenalis) descends behind the duodenum near the pylorus, and on reaching the lower border of the stomach, changes both its name and direction. It runs from right to left along the great curvature of the stomach, between the lamellæ of the great epiploon (omentum), assuming the name of gastro-epiploica dextra, (plate XV. p, p; plate XVI. fig. 1, k, k, fig. 2, e, e,) and inosculates with the gastro-epiploica sinistra derived from the splenic artery. It gives several branches to the duodenum and pancreas; one larger than the rest, is called pancreatico-duodenalis (plate XVI. fig. 1, i); it runs downwards and to the left in forming a curve in its course along the inner margin of the duodenum, distributing branches to it and the pancreas, and communicating with some small branches of the superior mesenteric artery.

Near the transverse fissure of the liver, the hepatic artery divides into its right and left branches, which are intended for the supply of the corresponding lobes of that organ. The left, or smaller division, lying in front of the vena portæ, diverges at an acute angle from the other branch, and turns outwards to reach the left extremity of the transverse fissure of the liver, where it enters its substance, divides and subdivides into minute ramusculi, ramifying in the intimate texture of the organ.

PLATE XXII.

The arteries of the male and female perinæum are here shown.

Fig. 1. The male perinæum; the superficial muscles and crus penis of the right side are removed to bring into view the deep vessels.

No. 1. The scrotum drawn upwards towards the abdomen. 2. The corpus cavernosum penis of the right side, divided. 3. The corpus spongiosum penis. 4. The bulb of the urethra. 5. The accelerator urinæ muscle. 6. The erector penis muscle. 7. The transversus perinæi. 8. The tendinous centre of the perinæum. 9. The sphincter ani muscle. 10, 10. The levator ani muscle of either side. 11. The coccyx. 12, 12. The glutæus maximus muscles. 13, 13. The posterior sacro-sciatic ligaments. 14, 14. The tuberosity of the ischium of either side. 15, 15. The semi-membranosus muscles. 16, 16. The adductor magnus muscles. 17, 17. The ramus of the pubis and ischium of each side. 18, 18. The gracilis muscles.

a, a. The internal pudic artery of each side (r. pudicus internus). b, b. External hæmorrhoidal branches (r. hæmorrhoidales externi). c, c. The superficial perinæal artery (r. perinæi superficialis). d. The transversalis perinæi, a branch of the superficial perinæal. e. The artery of the bulb (r. corporis bulbosi). f. The artery of the corpus cavernosum. g. The dorsalis penis artery.

Fig. 2. The female perinæum.

No. 1. The clitoris. 2. The corpus cavernosum clitoridis of the left side. 3. The corpus cavernosum, divided. 4, 4. The erector clitoridis muscle of either side. 5. The meatus of the urethra. 6. The vagina. 7, 7. The sphincter vaginæ. 8, 8. The levatores ani muscles. 9, 9. The sphincter ani. 10, 10. The glutæus maximus muscles. 11, 11. The tuberosity of the ischium of either side. 12, 12. The adductor magnus muscles. 13, 13. The gracilis muscles.

a, a. The internal pudic arteries. b, b. The external hæmorrhoidal arteries supplying the extremity of the rectum. c, c. The superficial perinæal arteries ramifying in the integument of the vulva. d, d. The transverse branch of the perinæum (r. transversus perinæi) ramifying upon the side of the vagina, and around the meatus urinarius. e, e. The artery of the corpus cavernosum on each side. f, f. The continuation of the internal pudic artery for the supply of the clitoris. g, g. The dorsalis clitoridis branches, ramifying upon the dorsum of the clitoris.



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Fig. 1.

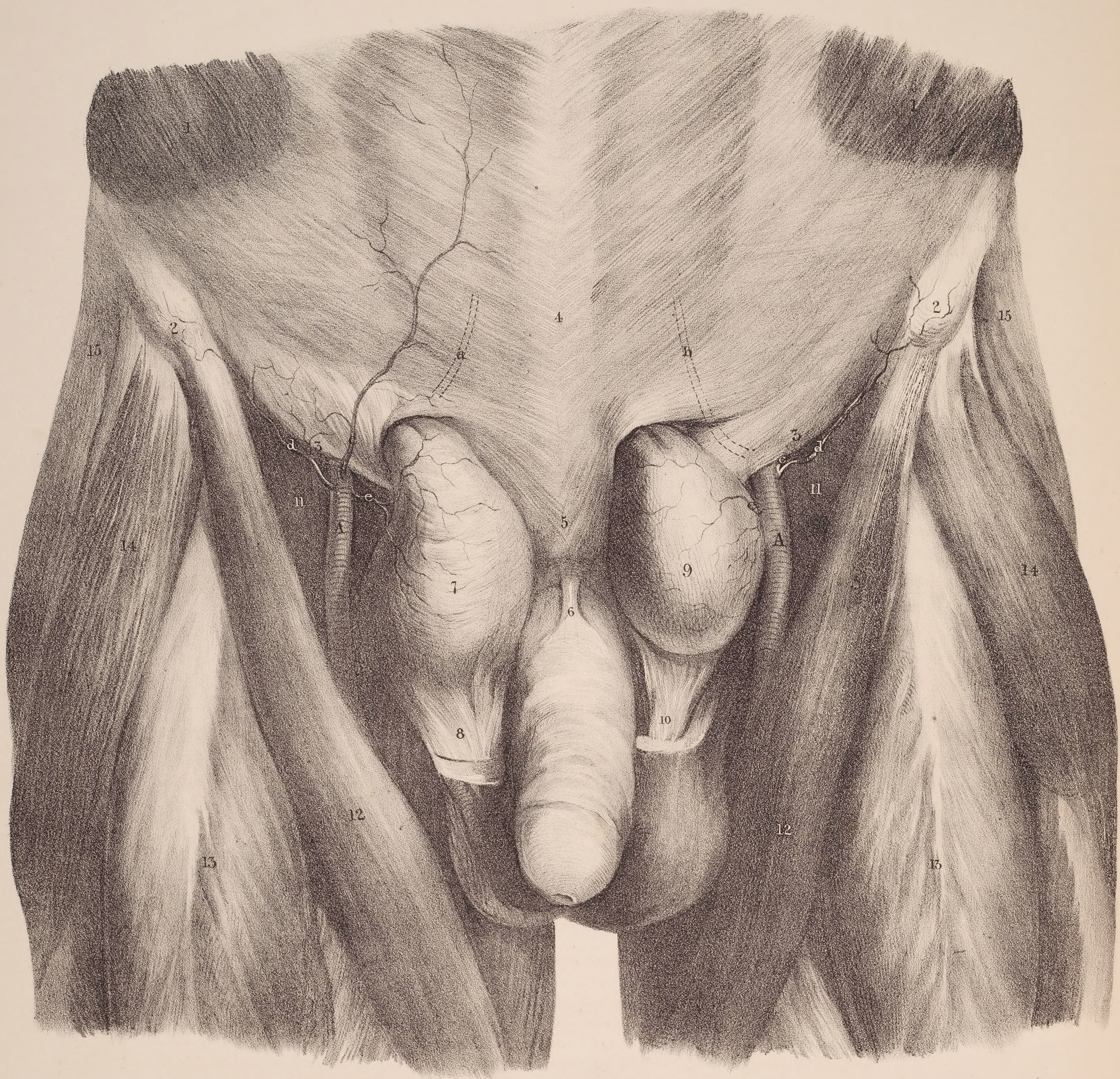
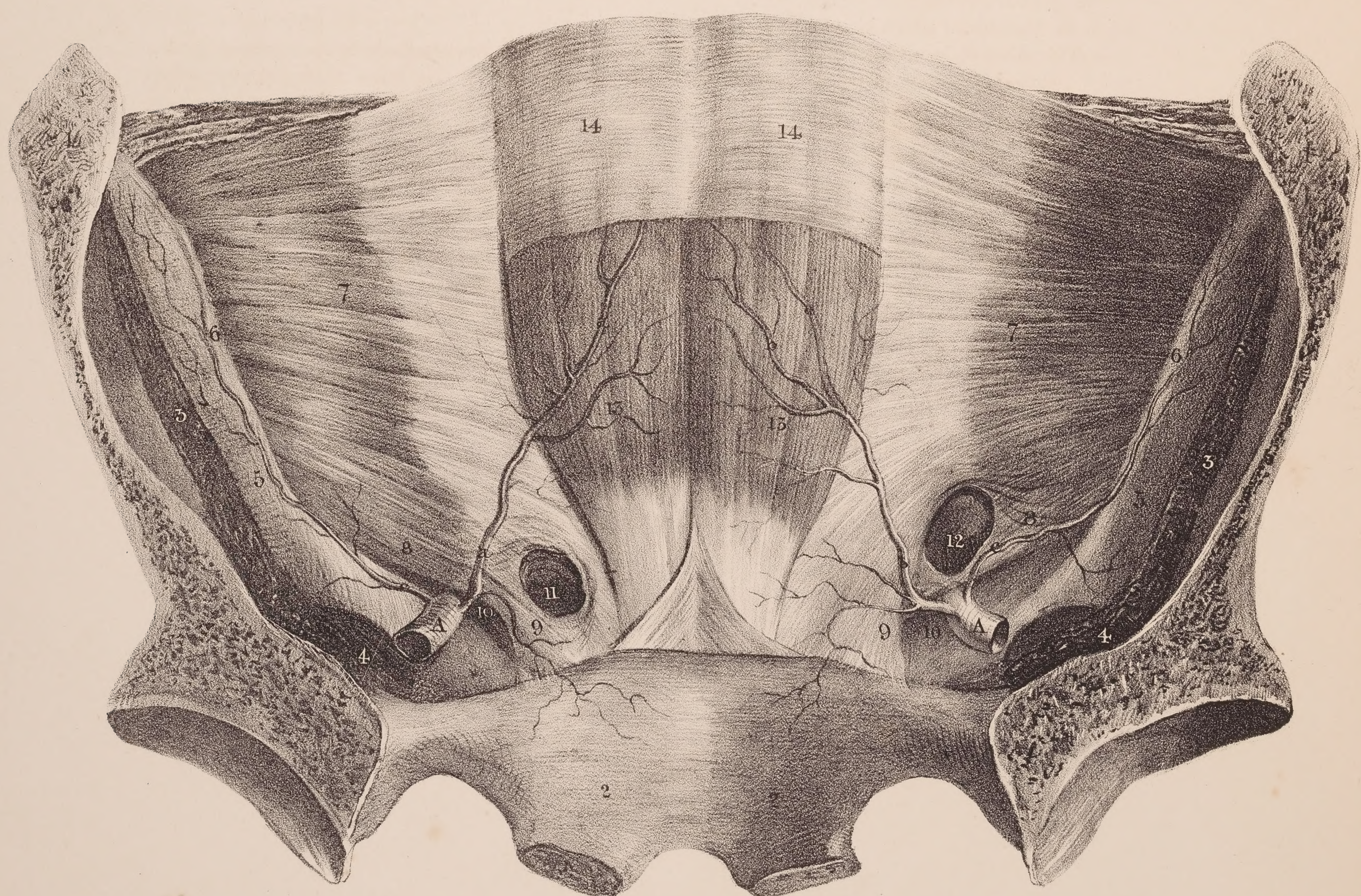


Fig. 2.



The right or larger branch inclines outwards to the right extremity of the transverse fissure. When crossing behind the cystic duct, it gives off a branch (plate XV. k; plate XVI. fig. 1, m: ramusculus cysticus), which turns upwards and forwards upon the neck of the gall-bladder, and divides into two ramusculi, of which one ramifies between its coats at its depending surface, the other between it and the liver. The right hepatic artery then divides into two or three branches, which enter the liver by its transverse fissure, and ramify in its substance, accompanying the divisions of the vena portæ and hepatic ducts.

3. *The Splenic artery* (plate XIV. e; plates XV. and XVI. E: a. splenica), in the adult, is the largest branch of the cœliac axis, from which it runs outwards, backwards, and to the left side. This artery will be found waving and tortuous in its course, as it passes along the upper border of the pancreas, to which it gives ramuli, and near the spleen divides into several branches. Some of these enter the fissure in that organ, and are distributed to its substance; three or four are reflected towards the bulging end of the stomach, in which they ramify. Its branches are the following:—

The Pancreatic branches (plate XVI. fig. 1, q, q; rami pancreatici) are variable in size and number; they are given off whilst the artery is passing along the pancreas, in the substance of which they ramify. One of larger size not unfrequently runs from left to right, in the direction of the pancreatic duct, and is called r. pancreaticus magnus.

The Splenic branches (plate XVI. fig. 1, p, p; r. splenici) are the proper terminal branches of the artery; they are five or six in number, and vary in length and size; they enter the spleen by the hilus or fissure in its concave surface, and divide within the organ until they become capillary.

The other branches of the splenic artery are reflected from it, and run a retrograde course.

The Gastric branches (plate XVI. fig. 1, o, o, fig. 2, d: r. gastrici; vasa brevia) vary from five to seven in number; they run from left to right, some issuing from the trunk of the splenic artery, others from its terminal branches. Enclosed within the splenic omentum, they reach the left extre-

PLATE XXIII.

This plate shows the relative position of the epigastric artery, to the neck of the sac in oblique and direct inguinal hernia.

Fig. 1 represents the lower part of the abdominal parietes, with two herniæ protruded through the external abdominal rings.

Nos. 1, 1. The external oblique muscle, on each side. 2, 2. The anterior superior spines of the ilium. 3, 3. Poupart's ligament at each side. 4. The linea alba. 5. The symphysis pubis. 6. The suspensory ligament of the penis. 7, The tumor formed by oblique inguinal hernia, passing obliquely between the abdominal parietes before it protrudes at the external abdominal ring. 8. The fascia of the spermatic cord thrown into folds as it quits the hernia to invest the lower part of the cord and testicle. 9. The tumor of a direct inguinal hernia passing directly outwards through the external abdominal ring. 10. The spermatic cord of the left side. 11, 11. The iliacus muscle, at each side. 12, 12. The sartorius muscle, at each side. 13, 13. The recti muscles. 14, 14. The tensor vaginæ femoris muscle, at each side. 15, 15. Part of the glutæus medius.

A, A. The femoral artery, at each side.

a. The course of the epigastric artery represented by dotted lines; it is drawn inwards by the "oblique inguinal hernia," and winds around the inner margin of the neck of the sac. b. The course of the epigastric artery, in relation to the "direct inguinal hernia," ascending upon the outer side of the neck of the sac. c, c. The superficial epigastric artery. d, d. The superficial circumflex ilii arteries. e, e. The superficial external pudic arteries, ramifying upon the intercolumnar fascia (fascia spermatica) of both the hernial tumors.

Fig. 2. The openings formed by the passage of the herniæ, seen from within, for the purpose of displaying more clearly the course of the epigastric artery in relation to the neck of the hernial sac. This view is obtained by sawing vertically through the transverse diameter of the pelvis, and removing its lower part.

Nos. 1, 1. The cut surface of the ilium and pubis. 2, 2. The inner surface of the os pubis. 3, 3. The divided iliac muscles. 4, 4. The psoas muscles divided. 5, 5. The iliac fascia on each side. 6, 6. The anterior superior spinous process of the ilium, at each side. 7, 7. The transversales muscles. 8, 8. Poupart's ligament, at each side. 9, 9. The conjoined tendon of the internal oblique and transversalis muscles, on either side. 10, 10. The crural rings. 11. The opening formed by the distention of the conjoined tendon for the passage of the "direct hernia." 12. The internal ring very much enlarged by the protrusion of "oblique inguinal hernia," opening beneath the lower border of the transversalis muscle. 13, 13. The recti muscles. 14, 14. The termination of the sheath of the recti muscles.

A, A. The external iliac arteries.

a, a. The epigastric artery (a. epigastrica) of the left side, ascending to the outer side of the opening for the "direct hernia." b, b. The epigastric artery of the right side passing upwards upon the inner side of the internal ring. c, c. The circumflex ilii arteries (a. circumflexa ilii) winding along Poupart's ligament on each side to their distribution.

imity of the stomach, where they divide and spread out between its coats, communicating with the coronary and epiploic arteries.

The left Gastro-epiploic artery (plate XVI. fig. 1, n, fig. 2, g; r. gastro-epiploicus sinister) turns forwards and downwards from the splenic, being at the same time reflected from left to right along the great curvature of the stomach, where it inosculates with the right gastro-epiploic branch. In its course, this vessel lies between the layers of the great omentum, to which it gives several long branches; many also pass upwards from it to both surfaces of the stomach, where they communicate with the other gastric arteries.

The superior Mesenteric artery (plate XIV. C.; plate XVII. A; plate XVIII. B: a. mesenterica superior) arises from the fore part of the aorta, a little below the cœliac. Its root lies beneath the pancreas, and above the transverse part of the duodenum; and its continuation is enclosed between the lamellæ of the mesentery. This vessel at first inclines downwards, and to the left side, but afterwards changes its direction, running transversely towards the right iliac fossa, opposite to which it inosculates with the ilio-colic branch. It thus describes a curve, whose concavity looks to the right side, so that its branches may be divided into two sets, viz. those which arise from its convexity and those from its concavity. Those which spring from the convex side of the vessel (rami intestini tenuis; plate XVII. k, l, m) are all intended for the supply of the jejunum and ilium. They are usually from sixteen to twenty in number. They run parallel to one another for some way, and then divide into two branches, each of which forms an arch, with a similar offset from the neighbouring branch. From the summit of the first set of arches branches issue, which divide, and re-communicate in the same way, until, finally, after forming four or five such tiers of arches, each smaller than the other, the ultimate ramusculi proceed directly to the intestines, and ramify in their coats. The branches from the right side of the mesenteric artery are given to the large intestine, arteriæ colicæ or rather rami colici.

The Ilio-colic branch (plate XVII. h; ramus ilio-colicus), which is the first of these, (taking them in their order from below upwards,) inclines downwards, and to the right side, towards the ilio-colic valve, near which it divides into two branches; of which one arches down, to inosculate with the termination of the mesenteric artery itself, and from the convexity of the arch branches go off towards the junction of the small with the large intestines, particularly to the valve; the other division ascends and inosculates with the following branch:—

The right Colic branch (plate XVII. e, f; r. colicus dexter) passes transversely to the middle of the ascending colon, opposite to which it resolves itself into two branches, of which one descends to communicate with the preceding vessel, whilst the other ascends to join in an arch with the succeeding:—

The middle Colic branch (plate XVII. a; plate XVIII. m: r. colicus medius) passes upwards to the transverse colon, and divides in a manner exactly similar to the vessels just noticed. One of its branches inclines to the right, where it inosculates with the preceding vessel; the other descends to the left side, and maintains a similar communication with the left colic branch, derived from the inferior mesenteric artery. From the arches of inosculation thus formed ramusculi pass to the intestine, for the supply of its coats.

The inferior Mesenteric artery (plate XIV. i; plate XVIII. a: a. mesenterica inferior) arises from the aorta, about an inch above its termination. It inclines downwards to the left iliac fossa to reach the sigmoid flexure of the colon, from which it descends into the pelvis, and, under the name of superior hæmorrhoidal artery, runs down behind the rectum. Its branches are:—

The left Colic branch (plate XVIII. b; ramus colicus sinister), which, close by the descending colon, divides into two branches, similar to those of the colic vessels of the opposite side. One of these branches passes upwards along the colon, and inosculates with the descending branch of the middle colic; whilst the descending branch passes along the sigmoid flexure, to which it sends ramusculi. It anastomoses with the sigmoid branch.

The Sigmoid branch (plate XVIII. f; r. sigmoideus) runs obliquely outwards to the sigmoid flexure of the colon; it divides into branches, some of which incline upwards and form arches with the preceding vessel, others turn downwards to the top of the rectum. From both, ramuli pass into the coats of the intestine.

The superior Hæmorrhoidal artery (plate XIV. m.; plate XVIII. g: r. hæmorrhoidalis superior).—The continuation of the vessel, having assumed the name of the superior hæmorrhoidal artery, lies in the fold of the meso-rectum, and ramifies in the coats of the intestine communicating with the middle and inferior hæmorrhoidal arteries.

We shall find, on even a slight inspection, a continued chain of anastomosis from one end of the alimentary canal to the other. The colic arteries form a vascular circle along the great intestine. The branches from the convex side of the mesenteric artery establish another range of arches along the small intestine, which is connected to the former by the ilio-colic artery. The superior mesenteric again anastomoses by some branches near its root with the pancreatico-duodenalis; the latter, at its commencement, is in a manner continuous with the pyloric artery; and so on, through the coronary and its ascending branches, a similar connexion is formed with the œsophageal branches, even up to the pharynx.

The middle sacral artery is the last of the single branches.

The middle Sacral artery (plate XIV. l: a. sacra media; r. sacer medius) is a small vessel about the size of a crow-quill, which arises from the extremity of the aorta, just at its bifurcation. From this point the artery proceeds downwards upon the last lumbar vertebra, and over the middle of the sacrum, as far as the coccyx, where it forms small arches of anastomosis with the lateral sacral arteries. From its anterior surface some ramusculi come forwards within the folds of the meso-rectum, and ramify upon the posterior surface of the intestine; and on each side others spread out upon the sacrum, and anastomose with the lateral sacral arteries, occasionally sending small twigs into the anterior sacral foramina.

The branches of the abdominal aorta, which arise in pairs, are, the phrenic, capsular, renal, spermatic, and lumbar.

The Phrenic arteries (plate XIV. a, b; a. phrenicæ) are two small vessels which usually arise from the aorta, on a level with the inferior surface of the diaphragm. They are very close at their origin from the fore part of the aorta, but instantly diverge, cross the crura of the diaphragm, and proceed upwards and outwards upon its central tendon and broad muscle. That of the left side having passed behind the œsophagus, runs up to the left of the œsophageal opening; whilst the right phrenic artery, after having passed behind the liver and the vena cava, lies to the right side of the opening in the diaphragm which transmits the latter. Each of these arteries divides into two branches before it reaches the central tendon of the diaphragm, of which one runs forwards towards the anterior margin of the thorax, distributing branches to the diaphragm, and finally anastomosing with the musculo-phrenic branch of the internal mammary artery. The other pursues a transverse direction towards the lateral margin of the thorax, and communicates with the termination of the intercostal arteries. Each phrenic artery gives small branches to the supra-renal capsule of its own side, and to the crus of the diaphragm; the left sends some to the œsophagus, and the right to the termination of the cava.

The Capsular or Supra-renal arteries (plate XIV. g; a. capsulares) are two very small vessels which arise from the aorta, on a level with the superior mesenteric artery, and incline obliquely outwards upon the crura of the diaphragm to the supra-renal capsules to which they are distributed, anastomosing at the same time with the branches derived from the phrenic artery.

The Renal or Emulgent arteries (plate XIV. D, D; a. renales) arise from the sides of the aorta, a little below the superior mesenteric artery, that of the right side being somewhat lower down than the left. The direction of each is outwards transversely, so as to form nearly a right-angle with the aorta; but it has at the same time an inclination backwards and downwards. In consequence of the position of the aorta upon the spine, the right renal artery has to run a somewhat longer course than the left to reach the kidney; in most cases it crosses behind the vena cava, and is overlapped by its accompanying vein. Previously to reaching the concave border of the kidney, each artery divides into four or five branches, the greater number of which usually lie intermediate between the vein and the pelvis of the kidney, the latter being posterior, the former anterior. These branches, after having passed deeply into the fissure of the kidney, divide into ramusculi, which diverge, and mutually anastomose, forming a vascular interlacement round the conical masses into which the tubuli uriniferi are aggregated; and so, when reduced to the size of capillaries, they constitute, with the ultimate radicles of the renal veins, the proper cortical or secreting structure of the kidney.

The Spermatic arteries (plate XIV. h, h; a. spermaticæ) are two very small vessels which arise from the fore part of the aorta, a little below the renal arteries. In the fœtus they are very short, as the testes are placed immediately beneath the kidneys; but the arteries acquire a proportional elongation as these organs remove from the lumbar region down into the scrotum. The direction of each spermatic artery is outwards and downwards, crossing the ureter, resting on the psoas muscle, and, after passing over the external iliac artery, turns forwards to the internal abdominal ring, where it comes into contact with the vas deferens, with which it descends through the canal, forming part of the spermatic cord as far as the testis, to the tubular structure of which it is distributed.

In the female these arteries (plate XX. a, a) do not pass out of the cavity. Their origin, direction, and relations, in the first part of their course conform to what obtains in the male; but at the margin of the pelvis they incline inwards and backwards, so as to get between the layers of the broad ligaments of the uterus, by which they are guided to the ovaries, to whose structure they are finally distributed. Some of their ramusculi can also be traced along the round ligament into the inguinal canal, and others as far as the uterus, to which they are conducted by the Fallopian tubes.

The Lumbar arteries (plate XIV. k, k; a. lumbales) are analogous to the intercostal arteries, for they are not only similar in their mode of origin, direction, and size, but also, like them, are intended for the supply of the lateral parts of the trunk. Moreover, as the intercostals, by communicating with the internal mammary arteries, form a vascular ring round the thorax, the lumbar arteries, by anastomosing with the epigastric, bear a similar relation to the walls of the abdomen. The lumbar arteries, when they arise singly from the aorta, which is not always the case, are five in number: the first three pass outwards under the crus of the diaphragm, the sympathetic nerve, and the psoas muscle,—the two last under the latter. Those of the right side pass behind the vena cava. In the first part of their course, they rest on the bodies of the vertebræ as they run towards the intervertebral spaces, where they give off two sets of branches, which take different directions; one being posterior, the other internal.

The Muscular branch (r. muscularis).—The posterior branch of each artery turns directly backwards, between the transverse processes of the vertebræ, and is distributed to the deep-seated lumbar muscles.

The Spinal branches (r. spinales).—The internal branches, usually two, or one which soon divides into two, enter the intervertebral foramina, and terminate in ramuli, of which some ramify upon the spinal cord and its membranes, communicating with the other spinal arteries; others supply the osseous structure, entering some of the foramina observable upon the surface of the bone, and may be called its nutritious branches (r. nutritii).

The artery itself, after giving off these branches, runs outwards transversely, maintaining its original direction, and after having passed first between the psoas and quadratus lumborum muscles it gets between the layers of abdominal muscles and divides into branches, which supply these muscles, and also maintain various anastomoses; for they communicate with the branches of the epigastric and mammary arteries in front, with the terminal branches of the intercostals superiorly, and with those of the ilio-lumbar and circumflex ilii inferiorly.

Varieties in the distribution, mode of origin, and relative size of the branches of the abdominal aorta, are of frequent occurrence.

The phrenic arteries, in some instances, arise not separately, but by a common trunk, from the

PLATE XXIV.

Varieties in the mode of origin and course of arterial branches within the pelvis, in reference to crural hernia, and the operation of lithotomy.

Fig. 1. Shows the obturator artery arising from the external iliac about half an inch above the epigastric.

No. 1. The symphysis pubis. 2. The anterior superior spinous process of the ilium. 3, 3. The two last lumbar vertebræ, divided by a vertical incision. 4. The sacrum. 5, 6. The rectum and bladder drawn down from their natural position in the pelvis.

A. The aorta. B. The left common iliac artery cut off. C. The right common iliac. D. The external iliac. E. The internal iliac artery.

a. The circumflex ilii artery. b. The epigastric artery divided. c. The obturator artery arising from the external iliac. d. The umbilical artery cut off. e. The anterior branch of the internal iliac artery. f. The internal pudic artery. g. The sciatic artery. h. The posterior branch of the internal iliac. i. The glutæal artery. k. The lateral sacral artery.

Fig. 2. The obturator artery arises from a common trunk with the epigastric, and curves downwards to the upper part of the obturator foramen. The artery in this course might have encircled the neck of a hernial sac.

In this figure, and in the following, the references to the secondary parts of the subject are the same as in fig. 1.

a. The circumflex ilii artery. b. The epigastric. c. The obturator artery.

Fig. 3. In this case, the internal pudic artery arose from the anterior branch of the internal iliac, passed forwards by the side of the bladder and prostrate gland, and divided into two branches: one, the artery of the corpus cavernosum; and the other, the dorsalis penis.

No. 7. The corpus cavernosum of the left side, divided. 8. The bulb of the urethra. 9. The septum scroti.

l. The obturator artery in its usual position, arising from the posterior branch of the internal iliac. m, m. The internal pudic artery arising from the umbilical trunk. n. The artery of the corpus cavernosum, o, o. The dorsalis penis artery. p. The superior vesical artery. q. An hæmorrhoidal branch from the internal iliac.

Plate 24.

Fig. 1.



Fig. 2.

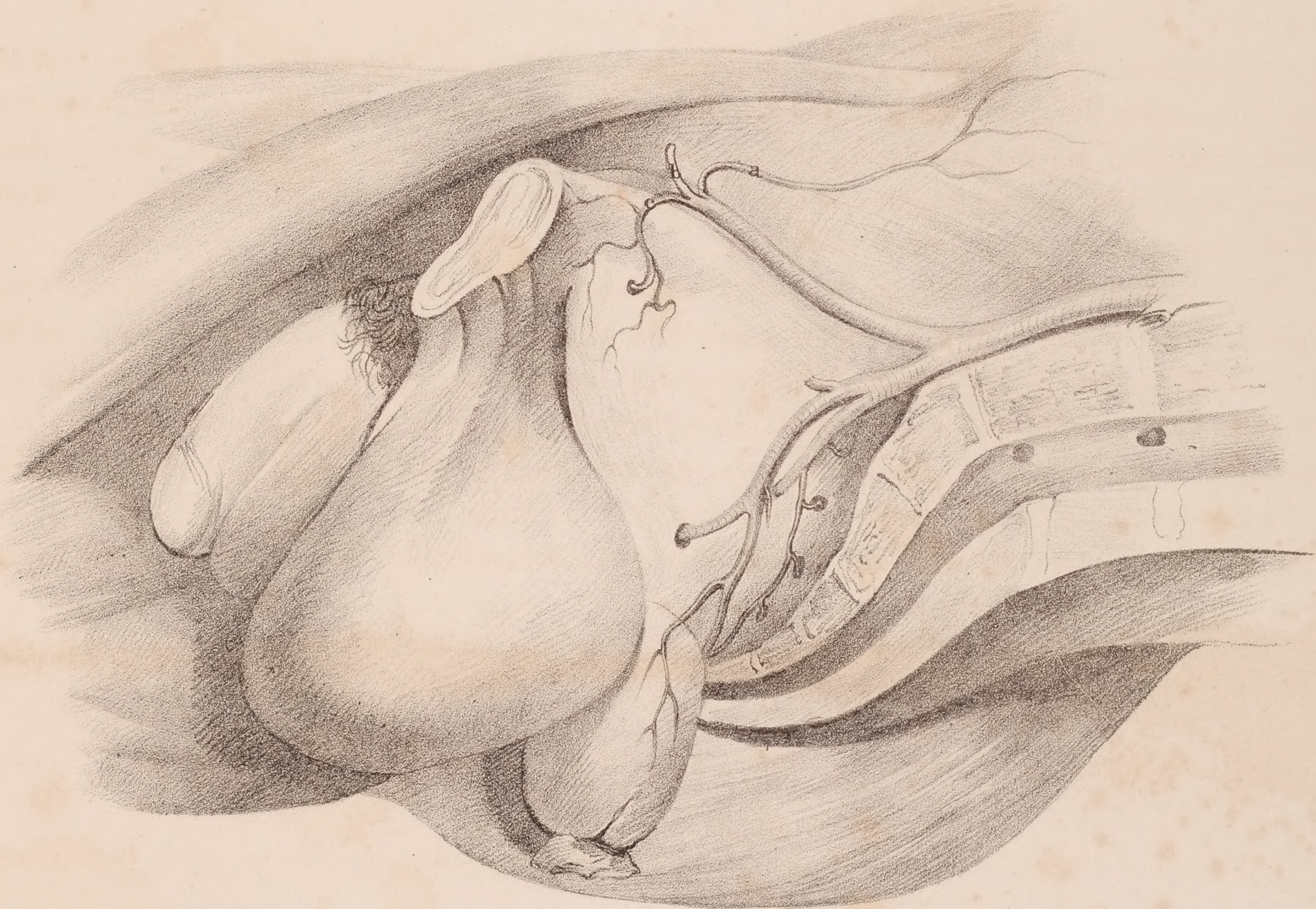
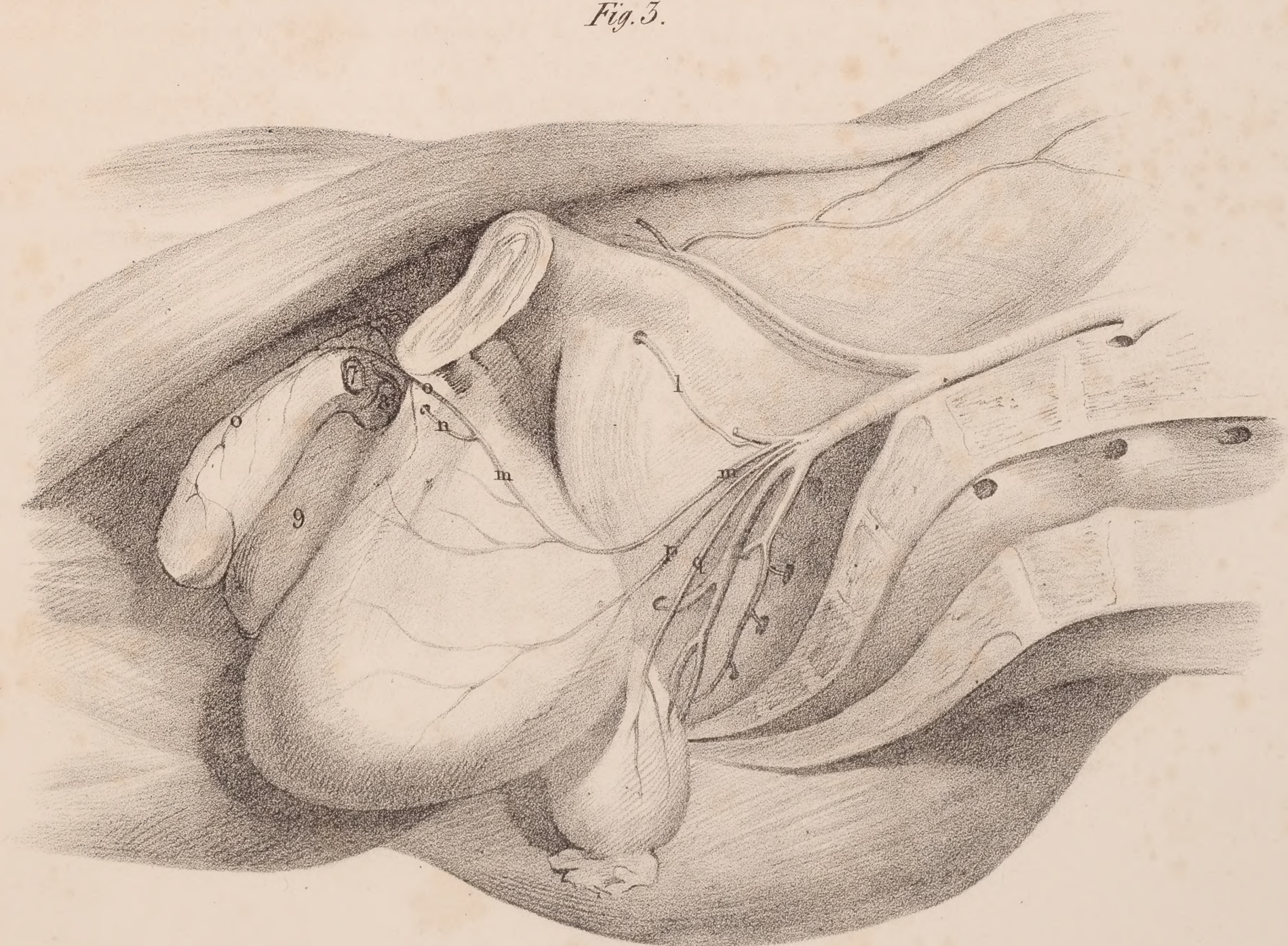


Fig. 3.



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fore part of the aorta; in others, whilst one comes off as usual from that vessel, the other issues from the coeliac, the coronary, the renal, or conjointly with the capsular. These variations, however, seem to exert little influence on their course and distribution.

The hepatic artery, instead of arising from the coeliac, has, in a few instances, been seen to come from the aorta, and in one case from the superior mesenteric. It is much more usual to find two arteries entering the liver in the ordinary way, which, instead of arising by a common trunk, come off separately, one from the coronary, the other from the coeliac or mesenteric. Dr. Green cites a case in which he found three hepatic arteries, "the left from the coeliac, in common with the coronaria ventriculi; another in the middle from the coeliac, also in common with the gastro-epiploica dextra; and a left (qu. right?) hepatic from the superior mesenteric, which gave off the cystic artery."

We frequently find the kidney at one or both sides receiving more arteries than one, but their size is diminished, from which it would appear that the deviation has gone merely a degree beyond that in which the single artery becomes divided into branches soon after its origin. The additional arteries in these cases come from the lower part of the aorta, or from the common iliac. When a kidney is placed lower than usual, for instance when situated in the pelvis, its artery is derived from the internal iliac or hypogastric. Meckel found in one case the two renal arteries of opposite sides arising by a common trunk from the fore part of the aorta.

The spermatic arteries occasionally arise by a common trunk, somewhat as the phrenics do; not unfrequently one of them is a branch of the renal.

The lumbar arteries of opposite sides, instead of arising separately from the aorta, may occasionally commence by a common trunk, whose branches pass out laterally, and continue their course in the ordinary way. The first lumbar not unfrequently arises conjointly with the last intercostal, and, in some instances, the last is a branch of the common iliac, or of the middle sacral.

The middle sacral artery represents the caudal prolongation of the aorta, but is necessarily diminutive in man, as the coccygeal vertebræ are merely rudimentary or atrophied. It sometimes devi-

PLATE XXV.

A front view of the arteries of the thigh: the right side shows the femoral artery with its superficial branches without any displacement of the muscles. On the left side the knee is turned outwards, and the sartorius and rectus muscles removed so as to expose the femoral artery in its entire course and exhibit its deeper branches.

Nos. 1, 1. The anterior superior spine of the ilium at each side. 2. The aponeurosis of the external oblique muscle. 3. Poupart's ligament. 4. The external abdominal ring. 5. The spermatic cord. 6. The suspensory ligament of the penis. 7, 7. The tensor vaginæ femoris muscle at each side. 8, 8. A part of the gluteus medius muscle at each side. 9, 9. The iliacus muscle at each side. 10, 10. The pectinei muscles. 11, 11. The adductor longus muscle at each side. 12, 12. The graciles muscles. 13, 13. Part of the adductor magnus muscle. 14. The sartorius muscle. 15. The rectus muscle. 16, 16. The vastus externus muscle at each side. 17, 17. The vastus internus muscle at each side. 18, 18. The patellæ. 19. The ligamentum patellæ of the right side. 20. The head of the fibula. 21. The insertion of the sartorius, semi-tendinosus, and gracilis muscles. 22. The psoas muscle of the left side, the abdominal parietes being removed. 23. The iliacus muscle within the pelvis. 24, 24. The cruræus muscle, the rectus having been removed. 25. The divided tendon of the rectus muscle. 26. The aponeurosis which is sent off from the adductor longus and magnus to become blended with the vastus internus, and beneath which the femoral artery passes into the popliteal region. 27. The semi-membranosus muscle. 28. The expansion of the sartorius tendon. 29. The tendon of the gracilis muscle. 30. The tendon of the semi-tendinosus muscle. 31. The gastrocnemius muscle.

A. The external iliac artery.

a. The epigastric artery, divided. b. The circumflex ilii artery.

B. B. The femoral artery (a. femoralis) of the left side, shown in its whole course. C. The femoral artery of the right side, seen in the upper triangular space before it is crossed by the sartorius muscle.

c. The superficial epigastric artery (r. epigastricus superficialis). d, d. The superficial circumflex ilii artery (r. circumflexus ilii superficialis). e, e. The superior external pudic artery (r. pudendus externus) at each side. f, f. The inferior external pudic artery at each side. g, g. The deep femoral artery (a. profunda femoris) at each side. h, h. The external circumflex artery (r. circumflexus externus) with its branches on either side. i, i. Muscular branches from the femoral artery. k, k. Branches of the obturator artery, piercing the adductor muscles. l, l. The anastomotic artery (r. anastomoticus). m, m. The superior internal articular artery (r. articularis) at each side. n, n. The inferior internal articular artery at each side. o, o. The superior external articular artery inosculating with descending branches from the external circumflex artery. p. The inferior external articular artery. q. The recurrent branch of the anterior tibial artery (r. recurrens). These branches form a mesh of arterial interlacements around the knee-joint.

ARTERIES.

O

ates a little to the side, and proceeds, not from the bifurcation of the aorta, but from one of the common iliac arteries, usually from that of the left side.

The abdominal aorta terminates by dividing into two trunks, called the common iliac arteries, which diverge at an acute angle. This bifurcation usually takes place on the body of the fourth lumbar vertebra, a little to the left of the middle line. The point here indicated will be found on a level with a line drawn from one crista ilii to the other, and may be transfixed by another passed horizontally backwards from the left margin of the umbilicus to the vertebral column, in the erect position of the body. It should, however, be observed, that the division not unfrequently takes place higher up or lower down by about the breadth of half a vertebra.

The common Iliac arteries (plate XIV. E, E; plate XXI. C; arteriæ iliacæ communes) commence at the bifurcation of the aorta, and diverge as they pass downwards and outwards to the sacro-iliac symphysis, where each of them divides into two primary branches,—the internal and external iliac arteries; the former being distributed to the viscera of the pelvis, and the soft parts on its external surface, as well as to the perinæum, whilst the latter is prolonged into the lower extremity, after having sent two important branches to the parietes of the abdomen.

The common iliac arteries of opposite sides present some differences in their direction, length, and relations to contiguous parts which deserve notice. The vessel on the right side passes off more abruptly than the left, and is somewhat longer, as the division of the aorta occurs to the left of the middle line. The right one also lies obliquely on the last lumbar vertebra, from which it is separated by both the common iliac veins, as they terminate in the vena cava. Both these vessels are covered by the peritonæum, and crossed by the ureters just at their point of division; the right being also crossed by the intestine ilium, where it is about to pass into the large intestine; whilst the left lies behind the sigmoid flexure of the colon. To the inner side of the left iliac artery, and supported on the last lumbar vertebra, lies its accompanying vein; on the right side the vein lies nearly behind the artery.

No branch that has received a name or deserves notice is given off by the common iliac trunks; but on reaching the sacro-iliac symphysis, as has been observed, each divides into the internal and external iliac arteries. We shall commence with the description of the internal iliac artery, chiefly because the parts which its branches supply, viz. the pelvic viscera and the perinæum, require to be examined at an early period.

Dissection.—In order to trace the branches of the internal iliac artery, it is necessary to obtain a lateral view of the parts within the pelvis. Previously to taking measures for this purpose, the perinæum should be dissected, and the pudic artery examined at the same time. When this has been done, saw through the os pubis a little outside the symphysis, also the sacro-iliac symphysis of the same side; detach the peritonæum and viscera from that side, and push them to the opposite; by these means the whole limb, and the lateral part of the pelvis, can be removed, leaving the contained organs with their vessels, and one side of the cavity undisturbed. When the parts are sponged, the arteries can be easily traced by commencing with the trunk and proceeding along the branches. In order to expose the branches of the gluteal and ischiadic arteries outside the pelvis, the gluteus maximus muscle must be dissected, detached from its origin, and reflected downwards.

The internal Iliac artery (plate XIV. G; plate XXI. E; a. iliaca interna, hypogastrica, pelvica) in the fœtus, both from its direction and size, appears to be the continuation of the common iliac trunk. It is nearly double the size of the external iliac artery, but in the adult the relation in this particular is reversed, the external iliac being larger. As the vessel in the fœtal state differs from that in the adult subject so materially, in length, relations, size, &c., it becomes necessary to describe its condition in the former, previously to considering its course and distribution in the latter.

Internal Iliac artery in the Fœtus.—When the vessels in the fœtus are injected (part or the whole of the umbilical cord remaining attached), it will be found that the internal iliac artery proceeds from the point at which the common trunk divides (sacro-iliac symphysis) forwards and a little downwards, to reach the side of the bladder. In this course the artery descends very little, as the body and fundus of the bladder project into the abdomen in early life. Guided by the side and fundus of the bladder, it reaches the inner surface of the parietes of the abdomen, along which it ascends to the umbilicus, converging to the vessel of the opposite side. When arrived at that aperture, the two arteries come into contact with the umbilical vein, round which they coil in a peculiar manner, until they reach the placenta, in the spongy texture of which their branches ramify until they become capillary. To that part of the vessel which intervenes between the sacro-iliac symphysis and the side of the bladder, the term *hypogastric* can in strictness be applied; the remainder thence

onward through the umbilicus to the placenta, being the proper *umbilical* artery, which performs an important part in carrying on the foetal circulation. In the first part of its course the vessel lies along the margin and side of the pelvis, covered by the peritonæum, then between that membrane and the side of the bladder, to which it gives branches (*superior vesical*), and, finally, between the peritonæum and the fascia transversalis, which separates it from the rectus muscle and its sheath. After birth, when the placental circulation is no longer carried on, the umbilical arteries gradually contract, become impervious, and reduced to the form of mere ligamentous cords, extending from the side of the bladder to the umbilicus. The remaining part, which still continues pervious, presents a diminution in size proportioned to the decrease in the quantity of blood circulated through it.

The *internal iliac artery in the adult* is a short stunted trunk, extending from the sacro-iliac symphysis to the sacro-sciatic notch, opposite to which it may be said to terminate by dividing into branches. The external side of the artery, just at its origin, is in contact with the inner border of the psoas muscle; lower down it rests against part of the sacral plexus. Behind it, is situated the internal iliac vein, and the communicating branch which passes from the lumbar to the sacral plexus; in front it is crossed by the ureter which separates it from the peritonæum. When the depth at which this vessel is situated is duly considered, as well as its close connexion with the different parts here enumerated, we can form some idea of the difficulty of passing a ligature round it in the living subject, without including the nerve, or injuring the vein. Its branches, though constant and regular in their existence and general distribution, still vary much in their origin. Some, which are rather small and variable, are distributed to the parts or organs within the pelvis, viz. the surface of the sacrum, the rectum, bladder, uterus, and vagina, whilst others of larger size are sent for the most part to the muscles within the cavity of the pelvis, and upon its outside. Viewing the internal iliac artery as we usually do after making a lateral section of the pelvis, it will be observed in most cases to present two primary branches at its point of division, one anterior, the other posterior: the latter gives off the ilio-lumbar, obturator, gluteal, and lateral sacral arteries; whilst from the anterior branch arise the umbilical (being originally its proper continuation), the ischiadic, and the pudic, which usually furnishes the vesical, uterine, and middle hæmorrhoidal arteries.

The *Ilio-lumbar artery* (plate XXI. l, c; r. ilio-lumbalis, iliaco-muscularis) resembles the lumbar branches of the aorta in direction and distribution. It passes outwards beneath the psoas muscle and external iliac vessels, to reach the margin of the iliac fossa, where it divides into two sets of branches. Of these, one passes upwards, ramifying in the psoas and quadratus muscles, where some of them communicate with those of the last lumbar arteries, whilst others enter the inter-vertebral foramina, and supply the parts lodged in the vertebral canal. The rest of its branches turn downwards and outwards, either in the substance of the iliacus muscle, or between it and the surface of the ilium. Some of these reach the crista and spine of that bone, where they anastomose with the circumflex ilii, and, if followed with attention, some can be traced forwards through the abdominal muscles, which they supply, and in which they communicate with the external branches of the epigastric artery.

The *obturator artery* (plate XXI. fig. 1, m, fig. 2, g.; plate XXIV. figs. 1, 2, c: r. obturatorius, sub-pubio femoralis) usually arises from the posterior branch of the internal iliac, but not unfrequently from the epigastric. The course and length of the internal or pelvic portion of the vessel will vary materially in these cases; the external or femoral is generally uniform. According to J. Cloquet,* who noted its distribution in more than two hundred instances, the number in which it arises from the iliac, as compared with that from the epigastric, may be stated as three to one. When the obturator artery arises from the internal iliac, it passes forwards close to the obturator internus muscle, and a little beneath the nerve of the same name, with which it gradually comes into contact. Both pierce the pelvic fascia, pass through a cellular interval between the pudic and ischiatic portions of the obturator muscle, and finally appear at the top of the thigh, after having made their way through the oval aperture in the thyrod or obturator membrane. In this course the nerve lies above the artery, both being placed between the pelvic fascia and peritonæum, as they run along the inner side of the pelvis. But when it arises from the epigastric artery, it has to pass downwards and inwards into the pelvis, in order to reach the thyrod foramen; and in doing so its course must lie along the margin of the crural ring, and must be placed close to some part of the neck of the hernial sac, should a portion of intestine be protruded through that aperture. If the obturator artery arises near the origin of the epigastric, or by a short trunk common to it and that vessel, it will be placed across the external side of the crural ring; but if it starts from a point higher up, as it has to incline inwards whilst descending into the pelvis, it will be found along the superior and internal border of the ring, and therefore almost sur-

* Recherches Anatomiques sur les Hernies.

rounding the neck of the sac. This, however, is rather an unusual occurrence; Breschet * appears to have met only a single instance of it. When the obturator artery has reached the thigh, it is supported on the external obturator muscle, and covered by the pectineus; it soon divides into two branches, one external, the other internal. The *external* branch inclines backwards and outwards, sending off branches, some for the supply of the obturator and quadratus muscles, whilst one or two, in some instances, reach the notch in the acetabulum, through which they pass, and are distributed to the hip-joint. The *internal* branch passes downwards between the adductors, supplies them as well as the pectineus and gracilis, and communicates with branches of the internal circumflex artery.

The *Gluteal artery* (plate XXI. fig. 1, n; plate XXVII. k; r. gluteus, la fessière, Chauss.) is the largest branch of the internal iliac artery; it inclines downwards and outwards, so as to reach the border of the great sciatic notch, beneath which it turns in order to appear on the dorsum of the pelvis. Its trunk will be found, accompanied by the gluteal vein and nerve, in the interval between the contiguous borders of the gluteus medius and pyriformis muscles; but it instantly divides into branches, one of which runs between the gluteus maximus and medius, and is superficial relatively to the other, which is placed between the latter muscle and the gluteus minimus. The first or superficial branch sends off in its course several ramusculi, which are distributed, some inwards (after piercing the tendinous origin of the gluteus maximus) to the side of the sacrum, anastomosing with the posterior branches of the sacral arteries; others, of considerable size, pass outwards between the gluteal muscles which they supply. The second or *deep* branch, situated between the gluteus medius and minimus, runs in an arched direction forwards, and may be said to divide into two branches. The superior one, holding the course of the vessel from which it arises, proceeds beneath the gluteus medius and tensor vaginæ femoris, towards the anterior spine of the ilium, and anastomoses with the circumflex ilii and the ascending branches of the external circumflex artery, after having freely supplied the muscles between which it passes. The other branch descends towards the great trochanter, supplies the gluteal muscles, and anastomoses with the external circumflex.

The *Sacral artery*, lateral (plate XXI. fig. 1, p; fig. 2, h, i; r. sacro-lateralis) is generally a small single vessel; sometimes there are two, running parallel in the usual direction, which is downwards and inwards, in front of the anterior sacral foramina, resting upon the origin of the pyriformis muscle and the primary branches of the sacral nerves. It lies about an inch outside the

PLATE XXVI.

The deep arteries of the anterior part of the thigh. This view is obtained by removing the sartorius and rectus muscles, and drawing the vastus internus outwards.

No. 1. The crest of the ilium. 2. The anterior superior process of the ilium. 3, 3. The iliacus muscle. 4, 4. The psoas magnus muscle. 5, 5. Poupart's ligament. 6. The crest of the os pubis. 7. The tensor vaginæ femoris muscle. 8. The gluteus medius muscle. 9. The pectineus muscle. 10. The lower border of the adductor brevis muscle. 11. The adductor magnus muscle. 12. The gracilis muscle. 13. Part of the adductor longus. 14. The vastus internus drawn outwards. 15. The cruræus muscle. 16. The vastus externus. 17. The tendon of the rectus muscle. 18. The vastus internus. 19. The patella. 20. The ligament of the patella.

A. The external iliac artery.

a. The circumflex ilii artery, divided. b. The epigastric artery, cut off.

B. The common femoral artery. c. The common origin of the superficial circumflex ilii artery and superficial epigastric. d. The deep external pudic artery.

C, C. The divided trunk of the superficial femoral artery. This vessel has been removed to show the course and branches of

D. The deep femoral artery (a. profunda femoris).

e. The external circumflex artery (r. circumflexus externus). f, f. Ascending branches of the external circumflex artery, inosculating with, g. The terminal branches of the glutæal artery. h, h. Middle branches of the external circumflex, which encircle the thigh, to inosculate with branches of the internal circumflex and sciatic arteries. i, i. Descending branches from the same artery, which communicate with ascending branches from the superior external articular artery. k. The internal circumflex artery (r. circumflexus internus) passing back between the pectineus and psoas muscles. l. The superior perforating artery (r. perforans superior). m. The middle perforating artery (r. perforans medius). n. The inferior perforating artery (r. perforans inferior). o. The termination of the anterior branch of the obturator artery (r. obturatorius). p. The posterior branch of the obturator artery. q. One branch of the anastomotic artery (r. anastomoticus), inosculating with the articular branches of the popliteal around the knee-joint. r. The superior internal articular artery. s. The inferior internal articular artery. t. The superior external articular artery. u. The inferior external articular artery. w. The recurrent branch of the anterior tibial artery.

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W. J. E. Wilson inv. ²

G. Swandale del^o

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middle sacral artery, having between them the sympathetic nerve, and runs as far as the coccyx, where it arches inwards to anastomose with the middle sacral and the lateral sacral of the opposite side. Sometimes it enters the third or fourth sacral foramen, and ramifies in the interior of the canal. Branches pass off anteriorly from this artery to the back part of the rectum and bladder; others, more considerable, incline backwards, and, after giving ramusculi to the pyriformis and sacral nerves, enter the foramina, and are distributed to the nerves within the canal, some being prolonged backwards through the posterior sacral foramina, so as to terminate upon the dorsal surface of the sacrum.

The Ischiadic artery (plate XXI. fig. 1, g; fig. 2, l; plate XXVII. o; r. ischiadicus,) is smaller than the gluteal, and arises somewhat lower down. It occasionally forms a common trunk with the pudic artery, in other instances it gives off that vessel when it is about to leave the pelvis. Placed for some way upon the pelvic surface of the pyriformis muscle and the sciatic plexus of nerves, it soon turns backwards beneath the border of that vessel, passing between it and the superior gemellus. In this situation it lies in the interval between the tuber ischii and great trochanter, covered by the gluteus maximus. It gives off several muscular branches, to supply the external rotators on which it lies, as well as the gluteus which conceals it. Two only of its numerous branches have received names, or require a particular notice. An internal branch, the coccygeal, (*ramus coccygeus*, plate XXVII. p, p,) inclines inwards, and pierces the great sacro-sciatic ligament, and so reaches the posterior surface of the coccyx, and supplies the coccygeus and levator ani muscles. A descending branch (*comes nervi ischiadici*, plate XXVII. r; Murray, Harrison,) runs downwards, accompanying the sciatic nerve, and sends a long branch into its interior, which passes some way along with it in its course through the thigh. Besides these, some branches, after supplying the upper part of the flexor muscles, anastomose with the gluteal, the circumflex, and superior perforating arteries.

The Pudic artery (plate XXI. fig. 1, f; fig. 2, n, n; plate XXII. a, a; r. pudicus internus, artère honteuse interne). The parts contained in the perinæum are supplied with blood from the internal pudic artery. This vessel usually arises as a distinct branch from the internal iliac artery, but occasionally is derived from a trunk common to it and the ischiadic. It inclines downwards and outwards to reach the spine of the ischium, lying at first on the sacral plexus, but afterwards passes between the pyriformis and coccygeus muscles, to gain the point just referred to. Having thus passed out of the pelvic cavity, it rests upon the external surface of the spine of the ischium, beneath which

PLATE XXVII.

The arteries on the back part of the hip and thigh are here shown. On the right side the superficial muscles remain undisturbed; on the left they are removed.

No. 1. The sacrum concealed by the aponeurosis of the latissimus dorsi muscle. 2. The coccyx. 3. Part of the obliquus externus muscle. 4. The dense fascia which covers in the gluteus medius muscle. 5. The gluteus maximus muscle. 6. The trochanter major. 7. The thick fascia on the outer side of the thigh. 8. The biceps muscle. 9. The semi-tendinosus muscle. 10, 10. The semi-membranosus muscle. 11. Part of the adductor magnus. 12. The gracilis muscle. 13. The sartorius muscle. 14, 14. The gastrocnemius muscle.—Left side; 15. The crest of the ilium. 16. The gluteus minimus muscle. 17. The pyriformis muscle. 18. The gemellus superior. 19. The tendon of the obturator internus. 20. The gemellus inferior. 21. The tuberosity of the ischium (tuber ischii). 22. The posterior sacro-sciatic ligament. 23. The obturator internus muscle. 24. The coccygeus muscle. 25. The quadratus femoris muscle. 26, 26. The adductor magnus muscle. 27. The separation in the adductor magnus, through which the femoral artery passes into the popliteal region. 28. The vastus externus muscle. 29. Part of the vastus internus. 30, 30. The linea aspera. 31. The popliteus muscle. 32. The head of the fibula.

a, a. Superficial branches of the ilio-lumbar artery. b, b. Superficial branches of the gluteal artery. c, c. Superficial branches of the ischiadic artery. d. A superficial branch from the external circumflex artery. e, e. Branches of the perforating arteries. f, f. Muscular branches from the popliteal artery. g. The superior external articular artery. h. The superior internal articular artery. i, i. Muscular branches (r. musculares, surales), distributed to the muscles of the calf of the leg.—Left side; k. The gluteal artery (r. gluteus). l. Its superficial branch. m. The deep branch of the gluteal artery. n. The descending branch. o. The ischiadic artery (r. ischiadicus). p, p. Its coccygeal branch (r. coccygeus). q, q. Inferior gluteal branches. r. The descending branch (*comes nervi ischiadici*). s, s. Terminal branches of the internal circumflex artery. t. A terminal branch from the obturator artery. u. The termination of the superior perforating artery. w. The middle perforating artery. x. The inferior perforating artery. y. The termination of the profunda artery.

A. A. The popliteal artery (a. poplitea).

z, z. Muscular branches (r. musculares) from the popliteal artery. a*. Superior internal articular artery (r. articularis). b*. Superior external articular artery. c*. Azygos articular artery (r. articularis azygos). d*. Inferior internal articular artery. e*. Inferior external articular artery.

ARTERIES.

P

it turns inwards through the lesser sciatic notch, and proceeds towards the inner surface of the tuber ischii. In this situation it lies on the obturator internus muscle, to which it is bound down by the obturator fascia, between which structures it lies, in its course forwards and upwards, along the rami of the pubes and ischium, towards the pubic arch. On approaching the latter, the artery pierces the fascia, and becomes placed between the crus penis and the bone, where it divides into its two ultimate branches, viz. ramus dorsalis penis and r. corporis cavernosi. In the first part of its course, whilst within the pelvis, the artery lies behind the bladder and vesiculæ seminales, and is supported by the pyriformis muscle and the sacral nerves; whilst outside the cavity it is placed between the sciatic ligaments, and rests upon the spine of the ischium. With these parts of the vessel we have nothing to do, in a practical point of view; but, as soon as it reaches the perinæal space, it enters into new and important relations. Its direction is forwards, upwards, and inwards, taking the direction of the rami of the os pubis and of the ischium. It rests against the obturator internus muscle, which separates it from the bone, being at first about an inch, or somewhat more, higher up than the margin of the tuber ischii, in which situation it is concealed and bound down by the obturator fascia. In the rest of its course, where it corresponds with the rami, it has the bone to its outside, the falciform process of the great sciatic ligament beneath, and the obturator fascia internally. In the course of the artery numerous branches are given off: we may divide them into three sets, viz. the pelvic, the perinæal, and the terminal. The pelvic branches consist, in the first place, of some small unnamed ramusculi given to the coccygeus, pyriformis, and obturator muscles; and, secondly, of some which pass inwards to the rectum, prostate, and bladder, and are named from the parts which they supply, viz. vesical, vaginal, uterine, and middle hæmorrhoidal. But as these sometimes come from the ischiadic, or internal iliac arteries, we must notice them separately, and not merely as branches of the pudic. The perinæal branches are the following:—

The external Hæmorrhoidal, (plate XXI. fig. 2, p, p; plate XXII. b, b; r. hæmorrhoidales externi,) two or three in number, incline inwards from the pudic artery, when it has reached the tuber ischii, and must necessarily pierce the fascia which binds it down, in order to reach the perinæum. They lie embedded in a quantity of adipose substance, lodged in the interval between the ischium and the sphincter ani, and soon branch out into ramusculi, which are distributed to the parts about the margin of the anus.

The superficial Perinæal artery (plate XXI. fig. 2, q; plate XXII. c, c; r. perinæi superficialis,) is a long, small, but still regular artery, which supplies the scrotum and upper part of the perinæum; it pierces the fascia a little higher up than the preceding, and then turns upwards close by, and parallel with, the rami of the ischium and pubes: it crosses the transversus perinæi muscle, and finally lies in a groove between the erector penis and accelerator urinæ. In this course, it gradually becomes superficial as it ascends, and in the male is distributed to the scrotum, in females to the labium. It not unfrequently gives off the following branch:—

The transverse artery of the Perinæum (plate XXI. fig. 2, r; plate XXII. d, d; r. transversus perinæi,) arises either from the pudic artery, or from the preceding branch, when on a level with the transversus perinæi muscle. As its name implies, it runs across the perinæum, and terminates in small twigs, which are distributed to the parts between the anus and bulb. Its size is very small.

The artery of the Bulb (plate XXI. fig. 2, t; plate XXII. fig. 1, e; r. corporis bulbosi,) passes horizontally inwards from the pudic artery when it is on a level with the bulb of the urethra; on reaching which it divides into ramusculi, that soon become capillary, and spread out into the erectile tissue constituting the bulb and corpus spongiosum.

The artery of the Corpus Cavernosum (plate XXI. fig. 2, v; plate XXII. fig. 1, f; fig. 2, e; r. corporis cavernosi,) is one of the terminal branches of the internal pudic. It turns forwards, and enters the body of the corpus cavernosum, in which it ramifies somewhat in the same way as the preceding vessel does in the corpus spongiosum and bulb.

The dorsal artery of the Penis (plate XXI. fig. 2, u, u; r. dorsalis penis,) passes upwards between the crus penis and the pubic symphysis, and, having pierced the suspensory ligament, runs forward parallel with its fellow of the opposite side, freely supplying the integument in its course. Near the corona glandis, each of these arteries branches out into ramusculi, some of which pierce the glans, whilst others supply the prepuce.

The pudic artery sometimes takes a different course from that here described, plate XXIV. fig. 3, m, m. Instead of passing out by the sciatic notch, it inclines inwards to the side of the bladder, runs along by the prostate gland, and escapes from the pelvis beneath the pubic arch; it thus gains the upper surface of the penis, and in the rest of its course represents the dorsal artery. Tiedemann gives

a drawing of this variety: Burns met four cases of it. Mr. Harrison, after alluding to one which he had dissected, observes,* “should such a variety exist in one who was to become the subject for the lateral operation of lithotomy, I fear this artery must be wounded; and, judging from its size and situation in those cases in which I have seen it take this course, I should apprehend very serious consequences from its division. It is not improbable but that some of those alarming and fatal cases of hæmorrhage which have occurred even to the best operators, may have depended on this variety.”

The dorsal artery of the penis has been observed to arise not from the pudic, but from the a. profunda femoris, from which it passed obliquely upwards and inwards to reach the root of the penis. Tiedemann gives a drawing of this variety.

The middle Hæmorrhoidal artery (plate XXI. fig. 1, h, i; r. hæmorrhoidalis medius,) is usually a small long vessel derived from the pudic artery; but it may come from the ischiadic or internal iliac. It inclines inwards as it descends, and at the same time comes forwards to gain the side and fore part of the rectum, to which it gives ramusculi, some being prolonged under the peritonæum to the base of the bladder and the vesiculæ seminales. The branches of this vessel form a link of connexion between the external hæmorrhoidal artery derived from the pudic artery, and the superior one, which comes from the inferior mesenteric.

Vesical arteries (r. vesicales), two or three in number, are derived from the pudic, from the middle hæmorrhoidal, or the ischiadic. They diverge as they pass forwards, one being directed downwards to the base of the bladder, upon which its ramusculi are lost; the other a little upwards to the side of that viscus. The latter may be called middle vesical, to distinguish it from those of the preceding vessel, as well as from some small branches which are situated higher up, and are derived from the internal iliac artery itself, or from the umbilical.

Uterine artery (r. uterinus) is usually a branch of the pudic, or of the middle hæmorrhoidal, sometimes of the internal iliac. It is very small, and becomes tortuous as it approaches the uterus, to which it is guided by the fold of the broad ligament within which it lies. Its ramusculi ramify in the proper structure of the uterus, some being continued upwards to the ovarium.

Vaginal artery (r. vaginalis) arises not unfrequently in common with the uterine, or may come singly from the pudic or middle hæmorrhoidal. It runs forwards and inwards to reach the side of the vagina, and then inclines to its upper surface, to which it gives several ramusculi, some extending to the bladder.

The external Iliac artery (plate XIV. F; plate XIX. A; plate XXI. D; a. iliaca externa, arteria cruralis in pelvi, Sæmm.) Previously to entering on its description, we may observe, that the vessel whose branches supply the lower extremity continues an undivided trunk from the point already indicated (*sacro-iliac symphysis*) as far as the lower border of the popliteus muscle, where it divides into the anterior and posterior tibial arteries; but, though it continues thus undivided, different parts of it have received different names, taken from the anatomical regions through which it passes. Whilst within the pelvis, and running along the iliac region, it is named *iliac*; in the upper two-thirds of the thigh, *femoral*; from thence to the lower boundary of the ham, *popliteal*. Each of these divisions (which are really artificial, being intended merely to facilitate the description of the vessel) is marked by some change in direction, in relation to contiguous parts, and also by a diminution in size, proportioned to the decrease in the quantity of contained fluid consequent on the giving off branches of supply at different intervals.

Dissection.—As the external iliac artery and its branches are usually studied immediately after the abdominal viscera have been examined, very little dissection is required to expose them in their entire extent. If the lower part of the parietes of the abdomen be turned down on the thigh, after the viscera have been removed, nothing more is necessary than to gently elevate the peritonæum from the iliac fossa, and draw it inwards towards the pelvis. The trunk of the vessel will then be observed resting on a smooth dense membrane (*fascia iliaca*) which is placed behind it, separating it from the psoas muscle; it is, however, bound down to the fascia by the sub-serous cellular tissue, which adheres firmly to it on each side of the vessel. The epigastric artery, if injected, may also be exposed in the lower and more important part of its course in the same way, namely, by removing the peritonæum from the fascia transversalis, which at once shows its relation to the cord and internal ring; to trace it higher up, the sheath of the rectus must be opened. If the abdomen be not opened, it will be necessary to cut through the three layers of abdominal muscles, in order to reach the

* Surgical Anatomy of Arteries, vol. ii. p. 124.

epigastric artery. The direction of the vessel may be indicated by drawing a line a little from the pubic side of the middle point, between the superior spine of the ilium and the symphysis pubis, upwards to the side of the ensiform cartilage.

The *external Iliac artery* extends from the sacro-iliac symphysis to Poupart's ligament, its direction being obliquely downwards and outwards, so as to reach the middle point between the anterior superior spinous process of the ilium and the symphysis pubis. In this course the vessel presents a slight curve, being at first depressed a little backwards into the pelvic cavity ; but lower down, where it passes over the brim of the pelvis and is supported by the psoas muscle, it comes a little forwards. It gives no branch of any consequence until it arrives within a few lines of its termination. It at first rests somewhat on the external iliac vein ; as it descends it receives some support from the psoas muscle being closely applied to its inner margin, and finally rests upon it for some way, the fascia iliaca interposing. To its external side lies the psoas muscle in its whole course, which separates it from the anterior crural (femoral) nerve ; the internal branch of the genito-crural nerve, as it passes inwards to its destination, runs in front of the artery. Anteriorly, the external iliac artery is covered by the peritonæum ; internally, it is accompanied by the vein of the same name, which at first is placed rather behind it, but gradually comes forward so as to lie on the same plane when they have reached Poupart's ligament. The artery at this point is supported by the inner side of the psoas muscle, the vein, by the os pubis, where a small part of its upper surface remains uncovered by muscular fibre, between the contiguous borders of the psoas and pectineus ; but between the vessels and the bone and muscle just named, the prolonged part of the fascia iliaca is interposed.

Just before its termination the artery gives its two branches, viz. the epigastric and circumflex ilii.

The *Epigastric artery* (plate XIV. s ; plate XIX. i, i ; r. epigastricus,) is situated obliquely at the inferior and anterior part of the abdominal parietes. It arises from the external iliac artery, usually about two or three lines above the margin of Poupart's ligament ; in some instances it comes off on a level with it, or even lower down. In the first case, it inclines downwards and inwards, so as to get on a level with the ligament ; after which it changes its direction, passing obliquely upwards and inwards, being placed between the fascia transversalis and the peritonæum, until it reaches midway between the umbilicus and pubes, where it enters the sheath of the rectus, in which it ascends above the umbilicus, and terminates in several small branches that anastomose with the terminal branches of the internal mammary and inferior intercostal arteries ; in its course it has communication also with some of the lumbar arteries. The epigastric artery is accompanied by one or two veins. In the male it is crossed by the vas deferens, in the female by the round ligament of the uterus. At first the duct lies in front of the artery, then turns round its external side as it descends towards the pelvis.

PLATE XXVIII.

This plate represents the principal varieties of arteries occurring in the thigh. The references to the muscles are the same in the three figures.

No. 1. The crest of the ilium. 2. The iliacus internus muscle. 3. The psoas magnus muscle. 4. The spine of the os pubis. 5. The pectineus muscle. 6. The anterior border of the gluteus medius muscle. 7. The tensor vaginæ femoris muscle. 8. The vastus externus. 9. The rectus. 10. The adductor longus muscle. 11. Part of the adductor magnus. 12. The vastus internus muscle. 13. The patella.

Fig. 1. The external iliac artery divides at about an inch above Poupart's ligament into two trunks of equal size : the internal one assumes the course and distribution of the superficial femoral artery ; the external one gives off the circumflex branches, and represents the profunda femoris artery.

A. The external iliac artery. B, B. The superficial femoral artery. C, C. The profunda femoris.

a. The internal circumflex artery. b. The external circumflex artery. c. One of the perforating arteries.

Fig. 2. The external iliac artery divides at Poupart's ligament into three branches of nearly equal size : the middle trunk, the proper continuation of the artery, follows the ordinary course of the superficial femoral ; the external one is the external circumflex artery ; and the internal division winds behind the femoral in the course of the profunda femoris.

A. The external iliac artery. B. The superficial femoral artery. C. The profunda femoris.

a. The external circumflex artery. b. The internal circumflex artery.

Fig. 3. This figure shows a variety of the internal circumflex artery, which gives off a branch that divides into the epigastric and obturator arteries. In a less rare case a large branch is given off by the common femoral, which divides into three branches of nearly equal size, the epigastric, the obturator, and internal circumflex.

A. The common femoral artery. B. The superficial femoral. C. The profunda femoris.

a. The external circumflex artery. b. The internal circumflex. c. The anomalous branch. d. The epigastric artery. e. The obturator artery.

Fig. 1.

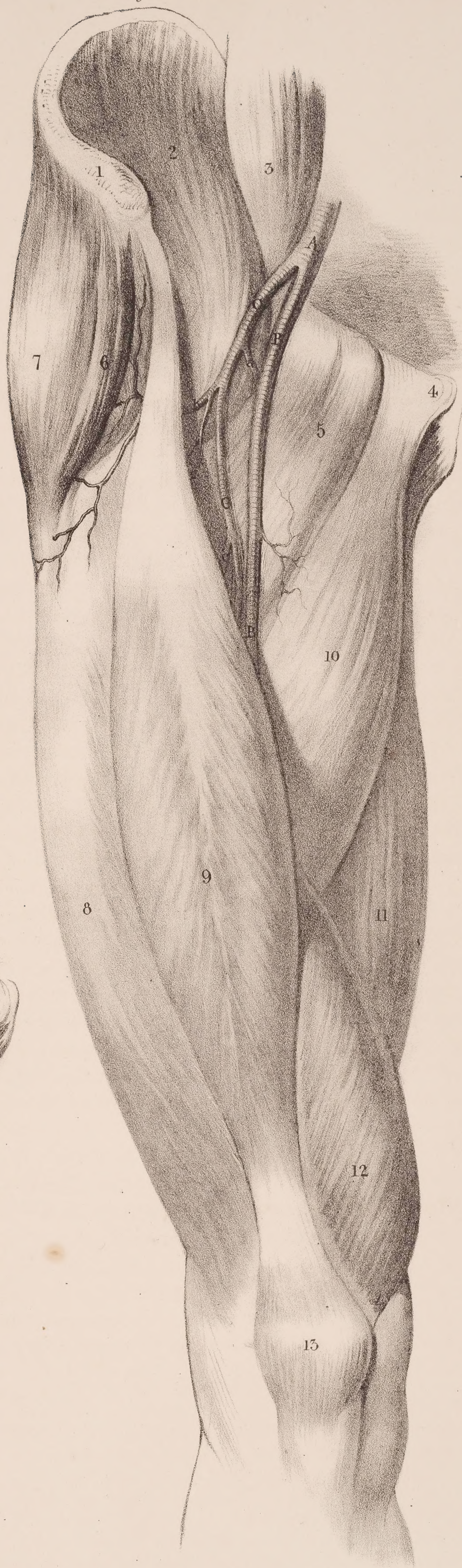


Fig. 2.



Fig. 3.



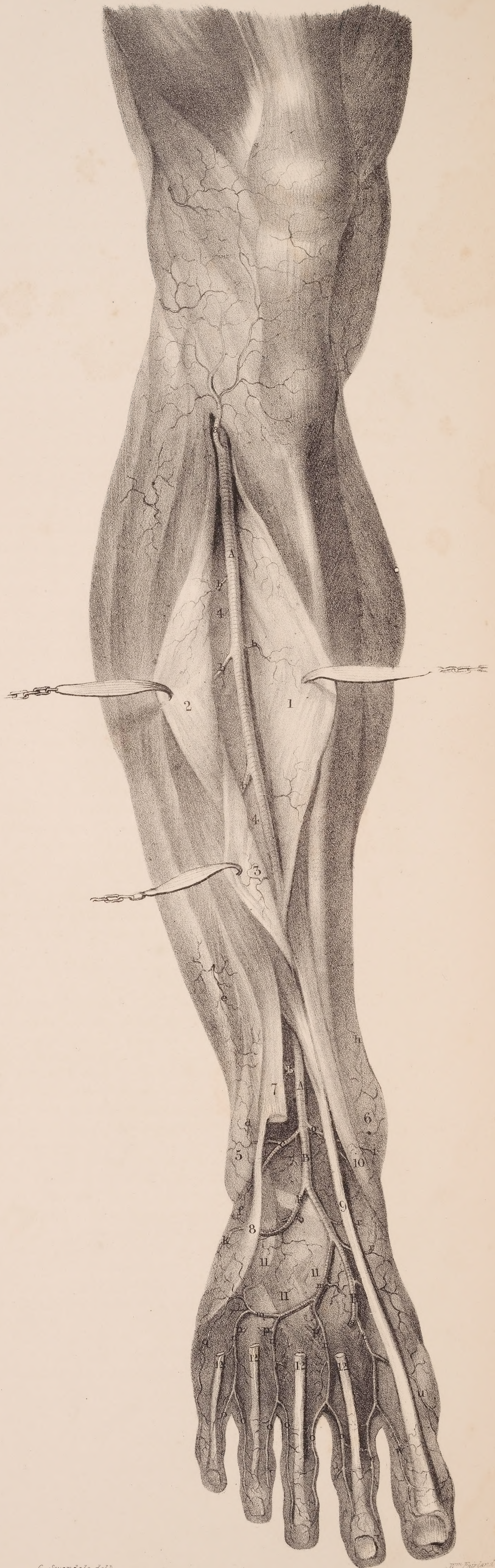
Fig. 1.



W. E. Wilson inv.

Plate 29.

Fig. 2.



G. Swandale del.

Wm. Fairland sculp.

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The vessel is therefore placed at the inner side of the internal abdominal ring, through which the spermatic cord passes. Its branches are the following :—

Cremasteric branch (plate XIX. s ; r. cremastericus).—A small branch descends along the spermatic cord beneath the cremaster muscle, passes through the external abdominal ring, and after supplying the parts in the cord, anastomoses with the proper spermatic artery.

Muscular branches (r. musculares).—Several muscular branches pass from its inner and outer

PLATE XXIX.

In this plate the arteries of the front part of the leg and foot are exhibited.

Fig. 1. The muscles and tendons are left in their natural situations; the superficial parts only of the anterior tibial artery and dorsal artery of the foot being seen.

No. 1. The vastus externus muscle inserted into the side of the tendon of, 2, the rectus muscle. 3. The vastus internus muscle. 4. The patella. 5. The ligament of the patella. 6. The tendon of the biceps femoris muscle. 7, 7. The tibia. 8, 8. The tibialis anticus muscle. 9, 9. The extensor proprius pollicis muscle and tendon. 10, 10. The extensor digitorum longus muscle, dividing into its four tendons. 11, 11. The peroneus tertius muscle. 12. The outer ankle (malleolus externus), formed by the lower extremity of the fibula. 13. The inner ankle (malleolus internus). 14. The anterior annular ligament. 15. The peroneus longus muscle. 16, 16. The external and internal borders of the soleus muscle. 17. The external head of the gastrocnemius muscle. 18. The internal head of the gastrocnemius. 19, 19. The extensor brevis digitorum muscle.

a, b, c, d. The four articular branches (r. articulares) of the popliteal, which form with, e, the recurrent branch (r. recurrens) of the anterior tibial artery, a net-work of anastomoses around the fore part of the knee-joint. f, f. Superficial branches of the anterior tibial artery perforating the muscles to ramify in the integument of the leg.

A. The anterior tibial artery (a. tibialis antica) in the lower part of its course, lying between the tendons of the extensor communis digitorum, and extensor proprius pollicis. B. The dorsal artery of the foot (a. dorsalis pedis).

g. The external malleolar artery (r. malleolaris externus) dividing into an ascending branch, h, which inosculates with, i, the anterior branch of the peroneal artery (r. peroneus anterior), and a descending branch, k, which anastomoses with branches of the tarsal artery. l. The internal malleolar artery (r. malleolaris internus) ramifying around the inner ankle. m. The tarsal branch (r. tarseus) of the dorsal artery of the foot. n. A superficial branch of the metatarsal artery. o. An internal branch which supplies the inner border of the foot, and inosculates with branches of the internal plantar artery. p. A small branch of the dorsalis pollicis artery, which ramifies along the inner border of the great toe. q. The dorsal artery of the great toe (a. dorsalis pollicis), giving off, r, a collateral branch for the supply of the inner border of the second toe. s, s. Interosseous branches (r. interossei) from the metatarsal artery, which divide into the collateral branches supplying the borders of the toes. t. A collateral branch for the outer side of the little toe.

Fig. 2. The muscles are here drawn aside, and some of the tendons removed, to display the anterior tibial artery in its whole course. The muscles being the same as those described in Fig. 1, particular reference is unnecessary.

No. 1. The tibialis anticus muscle drawn to one side. 2. The extensor digitorum longus muscle. 3. The extensor proprius pollicis muscle. 4, 4. The interosseous membrane. 5. The external malleolus. 6. The internal malleolus. 7. The divided tendons of the extensor digitorum longus muscle. 8. The tendon of the peroneus tertius muscle. 9. The tendon of the extensor proprius pollicis muscle. 10. The tendon of the tibialis anticus muscle. 11, 11. Ligamentous bands passing between the bones of the tarsus. 12, 12. The divided tendons of the extensor digitorum longus muscle.

A. A. The anterior tibial artery. B, B. The dorsal artery of the foot.

a. The recurrent branch of the anterior tibial. b, b. Muscular branches. c. The external malleolar artery. d. Its ascending branch inosculating with, e, the anterior branch of the peroneal artery. f. Its descending branch inosculating with the extremity of the tarsal artery. g. The internal malleolar artery. h. Ascending branches of the internal malleolar anastomosing with branches of the posterior tibial artery. i. Descending branches which inosculate with branches from the internal plantar artery, and internal branches from the dorsalis pedis artery. k, k. Tarsal artery (r. tarseus) inosculating above with the external malleolar artery, beneath with branches from the external plantar artery, and below with the metatarsal branch. l. A deep branch of the tarsal artery which supplies the articulations between the tarsal bones. m. The metatarsal artery (r. metatarsus) giving off, n, n, n, the interosseous branches (r. interossei), which divide at the root of the toes into the collateral branches, o, o, supplying the borders of the toes. p, p. Perforating branches (r. perforantes) dipping into the sole of the foot to communicate with the external plantar artery. q. The external collateral branch supplying the outer border of the little toe, generally a branch of the fourth interosseous branch. r, r. Branches from the dorsal artery supplying the inner border of the foot, which anastomose with the internal plantar artery. s. The perforating branch of the dorsal artery passing into the sole of the foot to inosculate with the termination of the external plantar artery. t. The dorsalis pollicis artery, which gives off the collateral branch, u, that runs along the inner border of the great toe. w, w. Collateral branches of the dorsalis pollicis artery supplying the outer border of the great toe and the inner side of the second.

sides to the parts along which it runs; some of the latter communicate with the branches of the lumbar arteries and of the circumflex ilii.

Anterior branches (plate XIX. g, g; r. anteriores).—Some small ramuli come forwards through the muscle, become sub-cutaneous, and communicate with the superficial epigastric artery.

Terminal branches (plate XIX. h; r. terminales).—The terminal branches ascend in the substance of the rectus muscle, and anastomose with the internal mammary and inferior intercostal arteries.

The circumflex Ilii artery (plate XIV. r; plate XIX. k; plate XXI. fig. 1, b; r. circumflexus ilii), smaller than the preceding, is placed obliquely along the lower border of the abdomen, lying at first within its parietes, and then between the muscular layers which form them. It arises from the external side of the iliac artery, on a level with Poupart's ligament, whose direction it takes as it runs upwards and outwards to the anterior superior spine of the ilium, where it turns along its crista, and divides into several branches, which are distributed to the abdominal muscles. About an inch after its origin, this artery pierces the fascia iliaca, and runs for some way between it and Poupart's ligament (corresponding with the line of insertion of that membrane); but opposite the superior spinous process of the ilium it gets between the transversalis and internal oblique muscles, to which it is finally distributed. It sends off:

Some slight twigs, which pierce the muscles, and along the groin anastomose with the superficial circumflex ilii, which comes from the femoral artery, and, farther on, with the branches of the gluteal artery; several smaller branches pass inwards to the iliacus muscle, and anastomose with the ilio-lumbar artery; its terminal branches communicate in the substance of the abdominal muscles with the lumbar arteries on the one hand, and the epigastric on the other.

Operations.—In order to expose and tie the external iliac artery in the living subject, it becomes necessary to divide the muscular parietes of the abdomen without injuring the peritonæum, after which this membrane must be pushed upwards from the iliac fossa. For this purpose, Mr. Abernethy made an incision about four inches long over the course of the artery. As the aorta divides on the fourth lumbar vertebra, and as the external iliac artery terminates midway between the anterior spine of the ilium and the pubic symphysis, it would at first sight appear that a line drawn from the umbilicus to the latter point would sufficiently indicate the course of the vessel, which in this, as in all other operations, is a matter of great consequence to determine accurately. But this line would fall to the inner side of the vessel, more particularly at the right side, in consequence of the transverse direction of the common iliac artery. Hence the sacro-iliac symphysis, being the commencement of the external iliac artery, is the point over which the line must pass, in order that it may coincide with the direction of the vessel. If then, from midway between the anterior superior spine of the ilium and the symphysis pubis, a line be drawn upwards to about an inch to the outside of the umbilicus, it will mark the course of the external iliac artery. The incision through the integuments (the patient being placed in the horizontal position) should begin four inches and a half above Poupart's ligament, and end within half an inch of that line. This exposes the aponeurosis of the obliquus externus, which is to be divided in the same direction and extent. The fore-finger of the left hand should in the next place be insinuated beneath the lower border of the obliquus internus and transversalis muscles, in order to detach them from the peritonæum; but some difficulty will be experienced in effecting this, as it is necessary to tear through the fascia transversalis, which is rather firm in this situation. When the muscles have been elevated for some way, they are to be cautiously divided by a probe-pointed bistoury, carried along the finger. It then only remains, in order to obtain a view of the artery, to push the bag of the peritonæum from below upwards and inwards, towards the margin of the pelvis. It should, however, be recollected, that as the artery is in some measure bound down to the fascia iliaca by the sub-serous cellular tissue, which adheres rather firmly to that membrane, it becomes necessary to free it from this connexion, by carefully scraping, with the extremity of a probe or with the nail, before the needle can be passed round it. As the vein lies close to the artery on its inner side, the needle must be insinuated between them, and passed from within outwards. No nerve, except a small branch of the genito-crural, is implicated in this operation, the anterior crural being separated from the artery by the breadth of the psoas muscle.

The mode of incision here pointed out, by cutting across the fibres of the abdominal muscles, necessarily weakens them where they most require to be strong. Its chief recommendation is, that it enables the operator to place the ligature higher up on the vessel than he could do otherwise, on which account it may be the only operation admissible in certain cases, for instance, where an aneurismal tumour has extended as far as Poupart's ligament, or a little above it. It may be farther observed, that whilst the operation is being performed in this way, much difficulty is experienced in

keeping the vessel exposed after the peritonæum and intestines have been pushed up, as they are continually forced down by the descent of the diaphragm; and as the sides of the wound are held apart by two retractors, it is difficult to apply a third at its superior angle, so as to bear off the peritonæum and viscera.

Sir Astley Cooper adopts quite a different method of operation; his incision is somewhat transverse with regard to the course of the artery. Commencing about half an inch above, and to the pubic side of the spine of the ilium, he divides the skin in a direction parallel with that of Poupart's ligament, the incision being prolonged somewhat farther than midway between the spine of the ilium and symphysis pubis. The point specified is the inner margin of the abdominal ring; but this is not a good point of reference, as it is not perceptible or tangible before the incision is made. The fibres of the external oblique muscle are in the next place to be divided to the same extent; and when the lunated flap thus formed is elevated, the lower border of the obliquus internus and transversalis is exposed, as well as the spermatic cord, as it passes beneath them. The cord will then serve as a guide to the epigastric artery, in front of which it lies, and this vessel to the iliac artery, which can be detached from its connexions without any further dissection. With this view the finger is passed along the cord, and through the fascia transversalis, or rather through the opening in it, which transmits the cord; the artery is then felt pulsating, and may be secured in the way recommended in the other mode of operation.

The Femoral artery (plate XXV. B, C; plate XXVI. B, C; a. femoralis communis; f. superficialis) is placed along the anterior and inner side of the thigh, extending from Poupart's ligament, where it is continuous with the external iliac, as far as the junction of the middle with the inferior third of the thigh, at which point the vessel changes its name and relation to the bone, becoming *popliteal*.

To expose the artery in the upper third of the Thigh.—In the first place, let the knee be slightly bent and the limb rotated outwards. And as in this position the course of the femoral artery is indicated by a line extended from midway between the anterior superior spine of the ilium and the pubic symphysis, to the lower border of the patella, the first incision through the skin should be made to the same extent, and in the same direction. In order to reflect the integuments with facility, a second incision may be made transversely at the junction of the upper with the middle third of the thigh; and finally, another in the same direction opposite the termination of the femoral artery. The flaps of skin thus formed are to be dissected back, so as to expose the fascia lata. Whilst doing this, you will observe the superficial epigastric artery running upwards over Poupart's ligament upon the external oblique muscle and the superficial pudic branch, inclining inwards to the pubes. In the next place, the fascia may be divided to the same extent as the skin, so as to expose the muscles, which are to be dissected carefully. A pudic branch will be found running inwards on the pectineus, and the circumflex ilii outwards in the direction of Poupart's ligament. These are all small branches. Lower down you will see a much larger vessel derived from the arteria profunda, viz. the external circumflex, which runs outwards beneath the sartorius and rectus, its trunk affording a clue to its different branches, which can be traced without any difficulty after the vessel has once passed the crural nerves. The dissection of the femoral artery in the upper part of the thigh requires some care, as it is embedded in a quantity of cellular tissue, and gives off its more important branches. The profunda and femoral veins also, which here lie close to it, together with their different branches, pour out blood when divided, which embarrasses the young dissector. Hence it often becomes necessary to divide the veins and remove them, after which the parts may be sponged and the dissection proceeded with. Before this measure is resorted to, the sheath of the vessels should be laid open, and the relative position of the vein and artery considered attentively.

To expose the artery in the middle third of the Thigh.—In the middle third of the thigh, little more is necessary in order to exhibit the vessel, after the fascia has been removed, than to turn the sartorius outwards; the course of the artery is then readily perceived, though it is bound down by the firm fascia already noticed, as passing across it from the adductors to the vastus. The relation of the saphenous nerve and vein to the femoral artery should be noted carefully, and its depth from the surface considered, which will at once point out the difficulty of cutting down upon and tying it in this situation, and the comparative facility with which it can be reached in the upper third of the thigh.

To expose the deep-seated artery (a. profunda).—When the femoral artery has been sufficiently examined, attention should be directed altogether to the deep-seated artery (a. profunda) and its branches. To expedite the dissection, the femoral artery and vein, and also the deep veins, had better be removed; and if, after this, the adductor longus be detached from its origin, and reflected

outwards over the vastus, the deep-seated artery will be fully exposed. Little difficulty can occur in tracing the external circumflex branch ; but as the internal one sinks deeply between the muscles, it becomes necessary to divide the pectineus at its origin, and turn it outwards on the thigh, after which the artery can be traced as far as the neck of the femur ; its terminating branches can be seen only when the posterior part of the thigh has been dissected. In this dissection the crural nerve and its branches should be attended to. They will be observed spreading out into a lash of filaments, which are distributed to the different muscles on the front and inner side of the thigh, whilst a few descend along the course of the artery.

To expose the perforating branches at the back of the Thigh.—When the subject is turned on its face, in order to dissect the posterior part of the limb, an incision may be carried through the skin from midway between the tuber ischii and trochanter major to the middle of the popliteal space. This may be met by two transverse incisions, similar to those made on the fore part of the thigh. When the flaps of integument are reflected, and the fascia examined, the latter may be divided to the same extent, which will expose the flexor muscles. These may be easily separated and drawn aside, after which the distribution of the perforating branches can be readily examined, as they lie on the adductor magnus, before their final termination. The anastomoses of the circumflex branches shall be considered after we have described the gluteal and sciatic arteries. As the incision through the integument here indicated corresponds with the course of the great sciatic nerve, it may be well to observe its relation and connexions whilst prosecuting the dissection of the arteries.

Resuming our description of the femoral artery, we remark *in limine*, that if the knee be semi-flexed, and the limb rotated outwards so as to turn the flat or inner side of the thigh somewhat forwards, the course of the vessel may be marked out by a line drawn, or a cord extended, from midway between the anterior superior spine of the ilium and the symphysis pubis, to the lower border of the patella. In this position of the limb, the vessel cannot be said to incline inwards ; but if the subject

PLATE XXX.

The arteries on the posterior part of the leg.

Fig. 1. represents the popliteal artery with its superficial branches ; also the posterior tibial artery and branches of the peroneal ; the muscles retaining their natural position.

No. 1. The sartorius muscle. 2. The tendon of the gracilis. 3. The semi-tendinosus muscle. 4. The semi-membranosus. 5. The biceps. 6, 6. The gastrocnemius muscle. 7, 7. Part of the soleus projecting beyond the expanded tendon of the gastrocnemius. 8. The flexor longus digitorum muscle. 9. The projection of the inner malleolus. 10. The tendon of the tibialis posticus muscle. 11. The tendon of the flexor longus digitorum. 12. The peroneus brevis muscle. 13. The tendon of the peroneus brevis. 14. The tendon of the peroneus longus. 15. The tendo Achillis inserted into the tuberosity of the os calcis.

A. The popliteal artery (a. poplitea) lying deeply in the popliteal space.

a. a. The superior articular arteries. b. The azygos articular artery. c, c. Muscular branches (r. musculares, surales) supplying the muscles of the calf of the leg.

B. The posterior tibial artery (a. tibialis postica).

d. d. Muscular and superficial branches derived from the posterior tibial artery. e. A muscular branch from the peroneal artery. f, f. The posterior branch of the peroneal artery (r. peroneus posterior). g. The anterior branch of the peroneal (r. peroneus anterior).

Fig. 2. The superficial muscles are here removed, and the deep layer, with the deep branches of the popliteal and posterior tibial arteries brought into view.

No. 1. The edge of the sartorius muscle. 2. The gracilis muscle. 3. The semi-tendinosus. 4. The semi-membranosus muscle. 5. The biceps muscle. 6, 6. The divided heads of the gastrocnemius muscle. 7. The lower expanded portion of the femur. 8. The posterior ligament of the knee-joint. 9, 9. The popliteal muscle. 10. The opening in the interosseous membrane, through which the anterior tibial artery passes. 11. The peroneus longus muscle. 12, 12. The tibialis posticus muscle. 13. The flexor longus digitorum. 14, 14. The flexor longus pollicis drawn aside with a hook. 15. The tendon of the flexor longus digitorum. 16. Part of the tendon of the flexor longus pollicis. 17. The inner ankle. 18. The tendon of the peroneus longus. 19. The divided tendo Achillis.

A. A. The popliteal artery. B, B. The posterior tibial artery (a. tibialis postica). C. The anterior tibial artery (a. tibialis antica).

a. a. The superior articular arteries. b. A branch supplying the ligaments of the joint. c, c. The inferior articular arteries. d, d. Muscular branches. e, e. The peroneal artery (a. peronea). f. Its anterior branch (r. peroneus anterior) piercing the interosseous membrane, to supply the muscles and integument about the fore part of the outer ankle. g. The posterior branch (r. peroneus posterior). h. The terminal branches of the posterior peroneal artery, anastomosing with the terminal branches (i.) of the anterior peroneal. k, k. Muscular branches (r. musculares) of the posterior tibial artery. l. A malleolar branch which anastomoses with the internal malleolar branch of the anterior tibial artery. m, m. Branches which anastomose around the heel with corresponding branches of the peroneal.

Fig. 1.

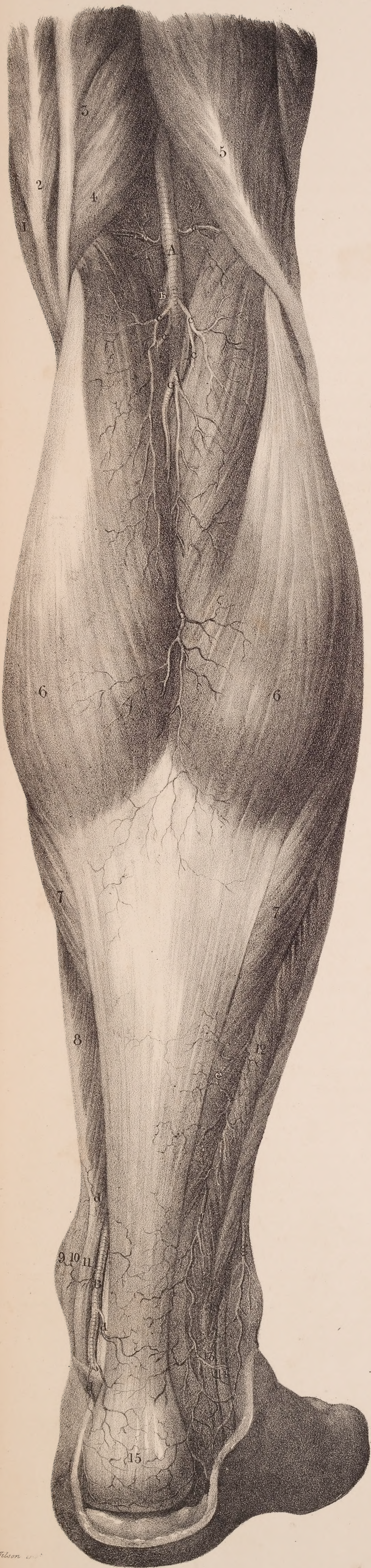


Fig. 2.



G. Swandale del.

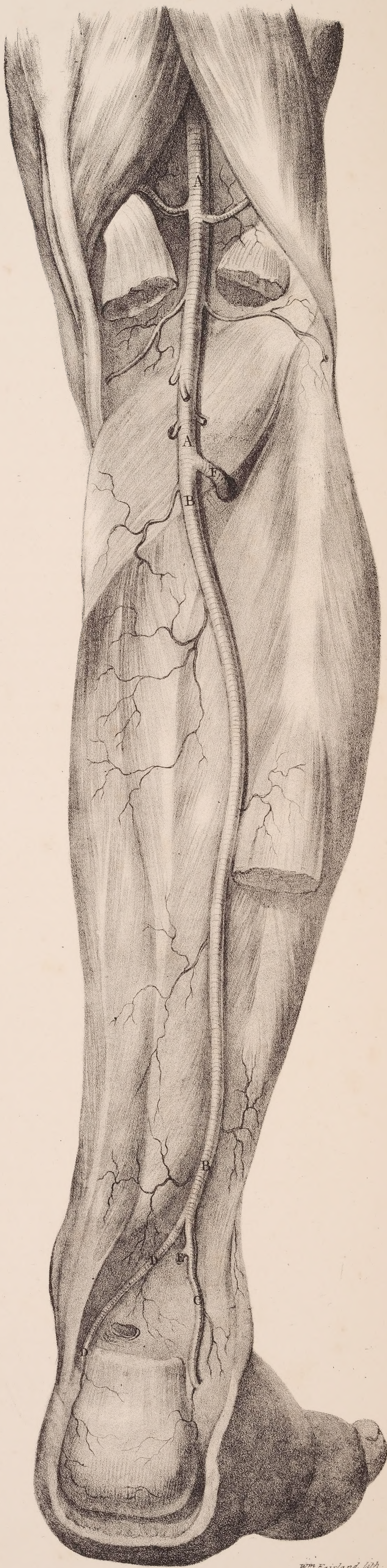
W. Fairland lith.

Fig. 1.



Plate 31.

Fig. 2.



be laid on the back, and both legs be placed closely together, the arteries of opposite sides will be nearer to one another, and therefore to the median line, in the popliteal space, than when under Poupart's ligament, which indicates a slight inclination inwards. A cursory inspection would, however, lead us to suppose the inclination to be greater than it really is, which is owing to the oblique direction of the femur. This is by no means a matter of indifference in a practical point of view. The superficial vein (vena saphena) has been wounded in a few instances during the operation for tying the femoral artery. This accident may happen to any individual who, from supposing that the artery inclines inwards as it descends, makes his first incision oblique, so as to correspond with such a direction of the vessel. It has been said,* that, if a line be drawn from midway between the spine of the ilium and the symphysis pubis, down to the middle of the popliteal space, it will indicate the course of the vessel. This is nearly correct; but, as this line runs along the inner surface of the thigh, its course is rendered much more oblique than that of the vessel, which is placed so much nearer the shaft of the femur. In the skeleton, whilst the femur hangs freely, a plummet line suspended from midway between the pubic symphysis and spine of the ilium, will drop exactly between the condyles of the femur, and mark out the general direction of the artery. In the upper third of the thigh it is directly downwards; some slight deviation inwards may occur in the middle third, where the vessel is borne off from the bone by the vastus muscle; but this cannot be so great as to require any obliquity in the direction of an incision made with the view of exposing it.

The direction of the vessel may then be said to be downwards, along the anterior and inner side of the thigh, becoming gradually deeper as it descends; and in its course it lies first on the psoas muscle (supported on its inner border), which separates it successively from the os pubis, the brim of the acetabulum, and the hip-joint. Below this the vessel rests on some branches of the arteria profunda and its accompanying vein, embedded in cellular tissue; these separate it from the pectineus and adductor brevis; it then passes over the adductor longus, and finally over the conjoined tendons of the latter and adductor magnus. Internally, it is in contact with the femoral vein, both vessels lying on the same plane in the first instance, where they are supported by the os pubis; but when the vein sinks behind the artery, the latter comes into contact with the adductor longus and sartorius muscles. Externally, it at first rests against the psoas muscle, which separates it from the anterior

PLATE XXXI.

Varieties occurring in the distribution of the arteries of the leg.

Fig. 1. The popliteal artery is continued downwards in the course of the peroneal, and divides just above the ankle into two branches, one of them supplying the outer ankle and outer side of the foot; the other, passing behind the inner ankle, becomes the plantar artery. A very small branch is given off from the peroneal at the lower border of the popliteus muscle, which represents the posterior tibial artery in its course, and inosculates with the plantar branch of the peroneal behind the inner ankle.

No. 1. The border of the sartorius muscle. 2. The tendon of the gracilis muscle. 3. The tendon of the semitendinosus muscle. 4. The semi-membranosus muscle. 5. The biceps muscle. 6, 6. The heads of the gastrocnemius muscle. 7, 7. The popliteus muscle. 8. The interosseous membrane. 9, 9. The tibialis posticus muscle. 10, 10. The flexor longus digitorum muscle. 11. The upper part of the flexor longus pollicis arising from the fibula. 12. The peroneus longus muscle. 13. The peroneus brevis muscle. 14. The opening of the tendinous sheath through which the tendon of the flexor longus pollicis passes into the foot. 15. The tendon of the flexor longus digitorum. 16. The tendon of the tibialis posticus muscle. 17. The tendon of the peroneus longus muscle. 18. The divided tendo Achillis.

A, A. The popliteal artery. B, B. The continuation of the popliteal artery downwards in the course of the peroneal artery of the regular distribution. C. A large branch passing behind the outer ankle, supplying the outer border of the foot. D, D. Another large branch, passing behind the inner ankle in the ordinary course of the posterior tibial, becomes the plantar artery.

a, a. The superior articular arteries. b, b. The inferior articular arteries. c, c. Muscular branches. d. The anterior tibial artery passing through the opening in the upper part of the interosseous membrane. e, e. A small long branch representing the posterior tibial artery; it inosculates below with the internal terminal branch of the peroneal. f, f. Muscular branches.

Fig. 2. The popliteal artery, at the lower border of the popliteus muscle, becomes the peroneal, which follows the course of the regular peroneal artery to the ankle, where it divides into three branches of nearly equal size. This variety is more rare than the preceding.

The references to this figure are the same as in Fig. 1.

A, A. The popliteal artery. B, B. The anomalous peroneal artery. C. The posterior malleolar branch. D, D. The branch which becomes the plantar artery. E. A large branch which pierces the interosseous membrane, and unites with the termination of the anterior tibial artery to form the dorsal artery of the foot (a. dorsalis pedis). F. The anterior tibial artery.

* Boyer, Traité d'Anatomie, tom. iii.

crural nerve ; but after that muscle has passed backwards to its insertion, it rests against the vastus internus : three or four branches of nerves will here be observed in contact with the sheath of the vessels.

The anterior surface of the artery in the upper third of the thigh is covered only by the common integument, the superficial fascia, the inguinal glands, and the fascia lata ; so that it is comparatively superficial, and may be easily compressed against the os pubis or the brim of the acetabulum. In the middle third of the limb the vessel is more deeply seated, as, in addition to the parts already mentioned, it is covered by the sartorius muscle, beneath which may be observed a fascia, composed of oblique fibres, passing from the adductor muscles to the vastus internus. This is thin superiorly, beginning where the sartorius overlaps the vessels, but gradually becomes dense and firm as it approaches the point at which the vessel passes through the opening in the adductor magnus. At Poupart's ligament the femoral vein lies close to the inner side of the artery, and on the same plane with it ; it rests on that part of the brim of the pelvis which corresponds with the interval between the contiguous borders of the psoas and pectineus muscles, separated from the bone by the prolonged part of the fascia iliaca, which passes down behind the vessels ; when distended, it overlays some of the outer fibres of the pectineus. As the vein descends it gradually inclines backwards, coiling round the artery, so that on reaching the popliteal space it is situated to the outer side and behind that vessel. The anterior crural nerve, at its exit from the abdomen, lies about three quarters of an inch to the outside of the artery, being separated from it by the breadth of the psoas muscle ; but when the muscle sinks backwards towards the trochanter minor, two or three branches of the nerve incline towards the artery, and accompany its sheath for some way ; of these, the largest, which from its ultimate distribution is called nervus saphenus, is found at the superior and external side of the artery during the middle part of its course, whilst the vein is situated posteriorly and internally for the same extent. This nerve does not accompany the artery and vein as they pass backwards through the adductor magnus ; it continues directly downwards to the inner condyle of the femur, and may be found between the tendons of the gracilis and sartorius muscles.

Branches of the Femoral artery.—The femoral artery gives off its chief branches in the superior part of its course, whilst it is yet uncovered by muscle. Some of these, small and unimportant, are distributed to the inguinal glands and adjacent muscles ; others, though small, have received names, and require a separate notice, viz. the external pudic (superior and inferior), the superficial epigastric, the superficial circumflex ilii, and, finally, a branch of considerable size—r. profundus femoris.

The external Pudic branches (plate XXIII. e ; plate XXV. e, f ; rami pudendi externi) arise, either separately or by a common origin, from the internal side of the femoral artery. The *superior*, or more superficial one, passes upwards and inwards to the spine of the os pubis, crosses the situation of the external abdominal ring, and is distributed to the integuments at the lower part of the abdomen and the external parts of generation. The *inferior* and deeper-seated one passes inwards, resting on the pectineus, and covered by the fascia lata, which it pierces on reaching the ramus of the os pubis, and is distributed to the scrotum in the male, or labium in the female, its branches inosculating with those of the superficial perinæal artery. The superior branch is necessarily cut across whilst the integuments are being divided in the operation for inguinal hernia.

The superficial Epigastric artery (plate XXIII. c ; plate XXV. c ; r. epigastricus superficialis) is larger than the preceding branch ; it arises from the femoral artery, about half an inch below Poupart's ligament, passes forwards through the saphenous opening in the fascia lata ; after which it changes its direction, and runs perpendicularly upwards on the abdomen, in the superficial fascia covering the obliquus externus. Its terminal branches, ascending as high as the umbilicus, anastomose with those of the proper or deep epigastric and internal mammary arteries. The rest of its branches ramify in the cellular tissue and superficial fascia, on the lower part of the abdomen. This vessel must be divided by the transverse incision made through the integuments in the operation for femoral hernia.

The superficial Circumflex Ilii artery (plate XXIII. d, d ; plate XXV. d, d ; r. circumflexus ilii superficialis) runs outwards and a little upwards, taking the direction of Poupart's ligament, to the spine of the ilium, across the psoas and iliacus muscles, to which it gives some branches. It terminates in several small twigs, which pierce the fascia lata, and anastomose with similar branches from the deep circumflex ilii, the external circumflex, and gluteal arteries.

The deep-seated Femoral artery (plate XXV. g, g ; plate XXVI. D ; r. profundus femoris) may be considered as the proper nutritious vessel of the thigh, its branches being distributed to it exclusively, whereas the femoral artery passes onwards to supply the leg and foot, giving off very few (and these

insignificant) branches whilst it corresponds with the femur. In this view of the destination of these vessels, the terms applied to them by Murray seem sufficiently appropriate. The short trunk intervening between Poupart's ligament and the origin of the profunda, he names *a. femoralis communis*; the continuation of the vessel as it passes along the thigh, *a. femoralis superficialis*; and its deep-seated branch, *a. femoralis profunda*. The profunda artery arises from the external and posterior surface of the femoral, usually from an inch and a half to two inches below Poupart's ligament. It at first inclines outwards in front of the iliacus muscle, but soon changes its direction, running downwards and backwards behind the femoral artery. Opposite the junction of the upper with the middle third of the femur, the profunda passes beneath the adductor longus muscle, and, inclining outwards to the linea aspera of the femur, soon divides into its terminal branches, which pass between that ridge of bone and the adductor magnus, to reach the posterior part of the thigh, where they are distributed to the long flexor muscles. The trunk of the profunda in this course lies at first on the psoas and iliacus muscles after their junction, then on the pectineus and adductor brevis, finally on the adductor magnus. In the first part of its course it is separated from the femoral artery by the profunda and femoral veins, and by a quantity of cellular tissue, in which all these vessels lie embedded; lower down, the adductor longus is interposed between them. In addition to a number of small and nameless branches, the profunda gives off the following, which deserve particular notice:—

The external Circumflex artery (plate XXV. h, h; plate XXVI. e; ramus circumflexus externus) arises from the profunda whilst it rests on the iliacus muscle, and after passing outwards for a short way beneath the sartorius and rectus muscles, and through the divisions of the anterior crural nerve, it gives off branches, which may be divided into three sets, from the directions which they take. The first continue transversely outwards in the course of the vessel, and, after passing over the crureus, pierce the vastus externus, so as to get between it and the bone just below the trochanter major, and so reach the posterior side of the thigh, where they anastomose with the internal circumflex branch, also with the gluteal and ischiadic. The ascending branches pass upwards beneath the sartorius and rectus, and finally under the tensor vaginae femoris, where they communicate with the terminal branches of the gluteal, and with some of the external descending branches of the circumflex ilii. The descending set pass outwards and downwards upon the extensor muscles, covered by the rectus. These are usually three or four in number, some being of a considerable size; most of them are distributed to the muscles on the fore-part of the thigh, but one or two can be traced as far as the knee, where they anastomose with the superior articular branches (internal and external) of the popliteal, and with the anastomotic branch of the femoral.

The internal Circumflex artery (plate XXVI. k; plate XXVII. s; r. circumflexus internus) arises from the inner and posterior side of the profunda, and turns directly backwards between the pectineus and psoas muscles, so that only a small part of it can be seen without disturbing these muscles. On reaching the tendon of the obturator externus muscle, which in a manner guides it to the posterior part of the thigh, it divides into two branches, or rather sets of branches. One of these ascends, and is distributed partly to the adductor brevis and gracilis, and partly to the external obturator muscle, where it anastomoses with the obturator artery; the other branch passes backwards above the trochanter minor, and appears on the posterior aspect of the limb, between the quadratus femoris and adductor magnus, where it anastomoses with the sciatic and superior perforating branches. When this transverse branch of the internal circumflex arrives opposite the hip-joint, it sends into it, through the notch in the acetabulum, an articular vessel, which passes beneath the transverse ligament, and, after supplying the adipose substance in the depth of the articulation, is guided to the head of the femur by the round ligament. In some instances this vessel is derived from the obturator artery, sometimes the joint receives one from both.

Perforating branches (plate XXVI. l, m, n; plate XXVII. u, w, x; r. perforantes), so called from piercing the adductor muscles, are three or four in number. The *first* passes backwards between the pectineus and adductor brevis, sometimes through the fibres of the latter, and finally through the adductor magnus, after which it immediately divides into branches, which are distributed to the adductor magnus, the biceps, and gluteus maximus, communicating with the ischiadic and internal circumflex arteries. The *second*, considerably larger than the first, passes through the adductor brevis and magnus, after which it divides into an ascending and descending branch; the former, passing up on the adductor, supplies the posterior muscles, and anastomoses, towards the great trochanter, with the circumflex and ischiadic arteries; the latter descends, and is distributed to the flexor muscles, where it communicates with the terminal branches of the profunda. A branch of this vessel usually enters the medullary foramen of the femur. The *third* perforating artery passes back

from the profunda, when it has got under cover of the adductor longus, pierces the adductor magnus, and, like the others, is distributed to the long flexor muscles.

The profunda (plate XXVII. y), after having given off these different vessels, becomes considerably diminished in size, and passes backwards close to the linea aspera, where it divides into branches, some of which are distributed to the short head of the biceps, the rest to the other hamstring muscles. These terminal branches do not pass to their destination exactly in the same way as the perforating set do: the latter pierce through the fibres of the adductors about an inch, or a little less, from their insertion; the former pass close to the linea aspera between it and some tendinous fibres which arch over the vessels, and protect them from compression by the muscle. At these points the muscle is attached, not to the bone, but to the tendinous fibres just referred to. A similar provision will be found in several other parts of the body: for instance, where the r. profundus humeri passes beneath the triceps muscle, &c.

The femoral artery in its course along the thigh gives branches to the contiguous muscles, but none of them merit a particular name or description. Close to its termination a small but regular branch arises from it,—

The Anastomotic branch (plate XXV. l, l; plate XXVI. q; ramus anastomoticus) descends from the femoral, as it is about to pass into the popliteal space, in a line continuous with that of the trunk, from which it arises. It pierces the tendinous fascia which binds down the femoral artery, and gives off two or three branches, whilst the vessel itself passes down to the inner condyle, guided by the prolonged tendon of the adductor magnus, and there anastomoses with the internal articular artery. Its branches pass obliquely outwards through the substance of the vastus internus, and communicate with the long descending branches of the external circumflex artery.

PLATE XXXII.

Fig. 1. The arteries which supply the inner ankle, and side of the foot.

No. 1. The tibia. 2. The internal malleolus. 3. The tibialis anticus muscle. 4. The soleus muscle. 5. The expansion of the gastrocnemius tendon. 6, 6. The flexor digitorum longus muscle. 7. The tendon of the tibialis posticus. 8. The flexor pollicis longus muscle. 9. The tendo Achillis. 10. The internal annular ligament. 11. The anterior annular ligament. 12. The tendon of the tibialis anticus muscle. 13. The tendon of the extensor pollicis proprius. 14, 14. The abductor pollicis muscle. 15. The flexor digitorum brevis.

A. A. The posterior tibial artery (a. tibialis postica).

a. a. Muscular and superficial branches from the posterior tibial, inosculating with, b, b, superficial branches of the anterior tibial artery. c, c. Superficial branches from the posterior tibial, inosculating around the heel with, d, branches of the posterior peroneal artery. e, e. Anterior branches of the posterior tibial, inosculating with, f, f, branches of the internal malleolar artery, derived from the anterior tibial. g, g. Superficial branches of the internal plantar artery, supplying the side of the foot, and inosculating with branches from the dorsal artery. h, h. Branches of the internal plantar artery, supplying the integument in the sole of the foot. i. Internal collateral branch from the internal plantar artery.

B. The dorsal artery of the foot (a. dorsalis pedis) lying to the outer side of the tendon of the extensor pollicis proprius.

k. Internal collateral branch of the great toe, from the dorsalis pollicis artery. l, l. Dorsal digital ramuli from the interosseous branches of the metatarsal artery.

Fig. 2. The arteries ramifying around the outer ankle and side of the foot.

No. 1. Tendinous expansion of the gastrocnemius muscle. 2. The soleus muscle. 3. The peroneus longus. 4, 4. The peroneus brevis muscle. 5. The extensor digitorum longus. 6. The tibialis anticus muscle. 7. The peroneus tertius. 8. The lower extremity of the fibula forming the external ankle. 9, 9. The tendon of the peroneus longus. 10. The tendo Achillis. 11. The anterior annular ligament. 12. The external annular ligament. 13, 13. The abductor digiti minimi muscle. 14. The tendon of the peroneus brevis muscle. 15, 15. The extensor digitorum brevis muscle. 16. The tendon of the peroneus tertius. 17. The tendons of the extensor digitorum longus muscle. 18. The tendon of the extensor pollicis proprius. 19, 19. The four tendons of the extensor digitorum brevis.

a. A superficial branch of the posterior tibial artery. b, b. Superficial branches of the posterior peroneal artery. c, c. The posterior peroneal artery (a. peronea posterior). d. The anterior peroneal artery (a. peronea anterior). e, e. Cutaneous branches of the anterior tibial artery. f, f. Branches of the external malleolar inosculating with terminal branches of the peroneal arteries, also with branches of the tarsal and external plantar arteries.

A. A. The dorsal artery of the foot (a. dorsalis pedis).

g. g. Terminal branches of the tarsal artery (a. tarsea), inosculating with, h, a branch of the external plantar artery. i. A branch of the metatarsal artery (a. metatarsea). k. The dorsalis pollicis artery, dividing into branches for the supply of the inner toes. l, l. Digital ramuli, derived from the interosseous branches of the metatarsea. m. The external collateral branch of the external plantar artery.

Fig. 1.



Fig. 2.



Plate 53.

Fig. 1.

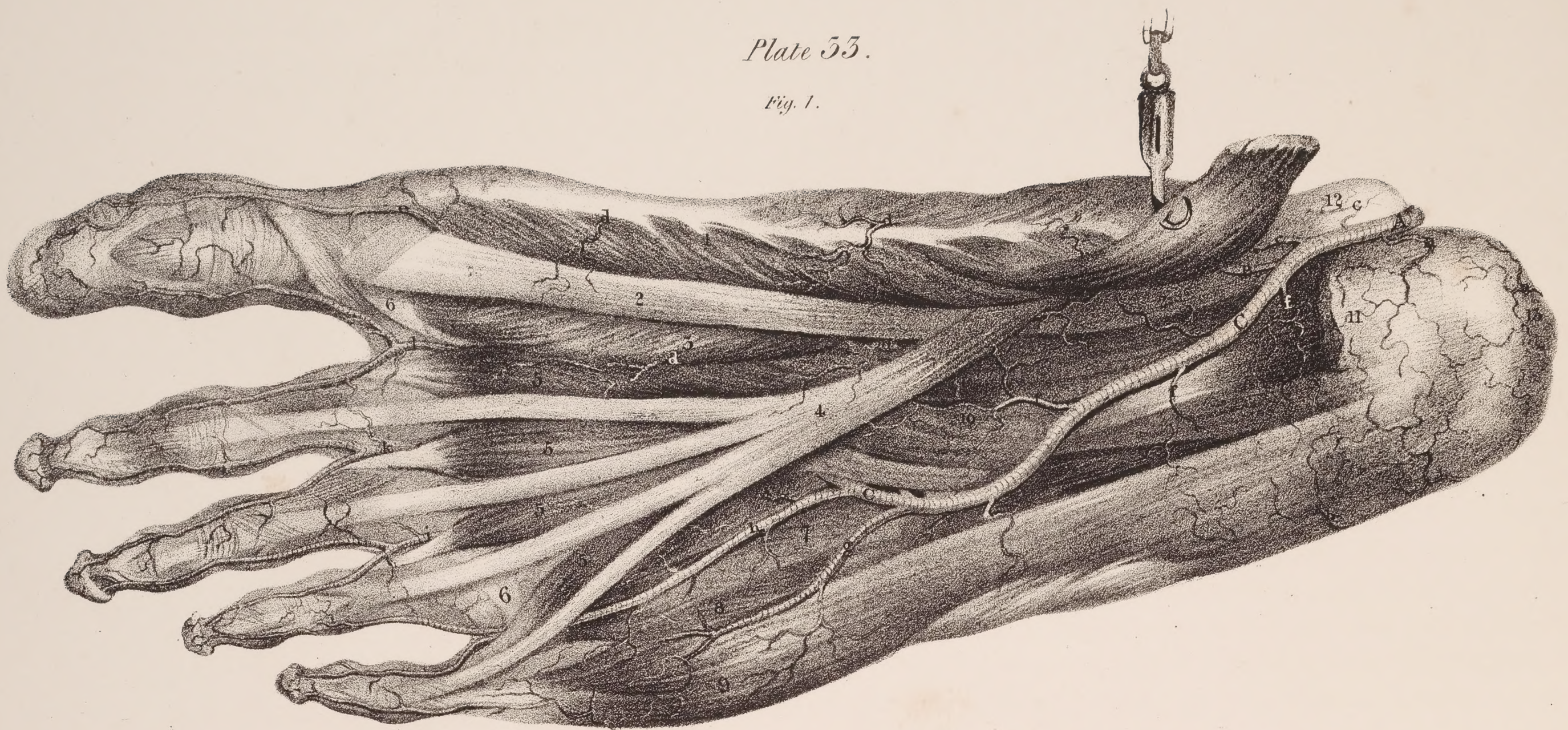


Fig. 3.

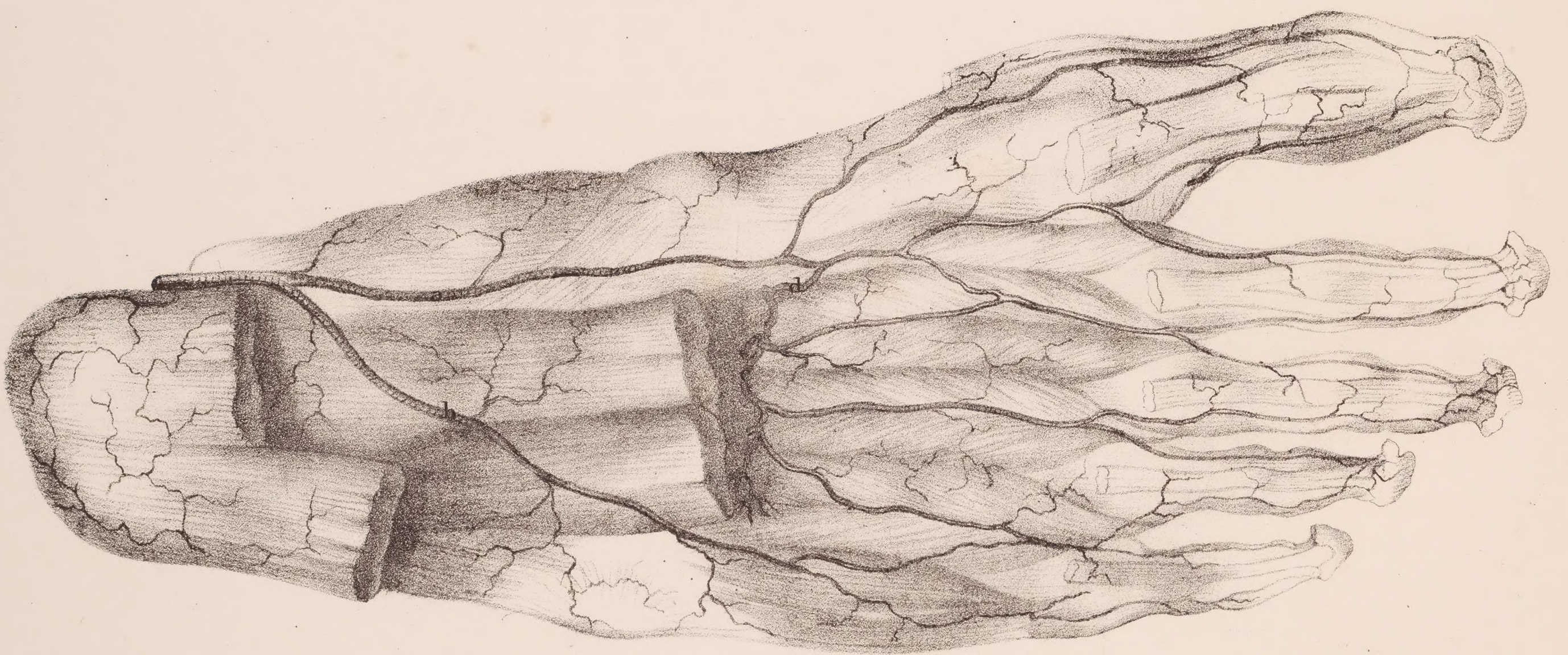
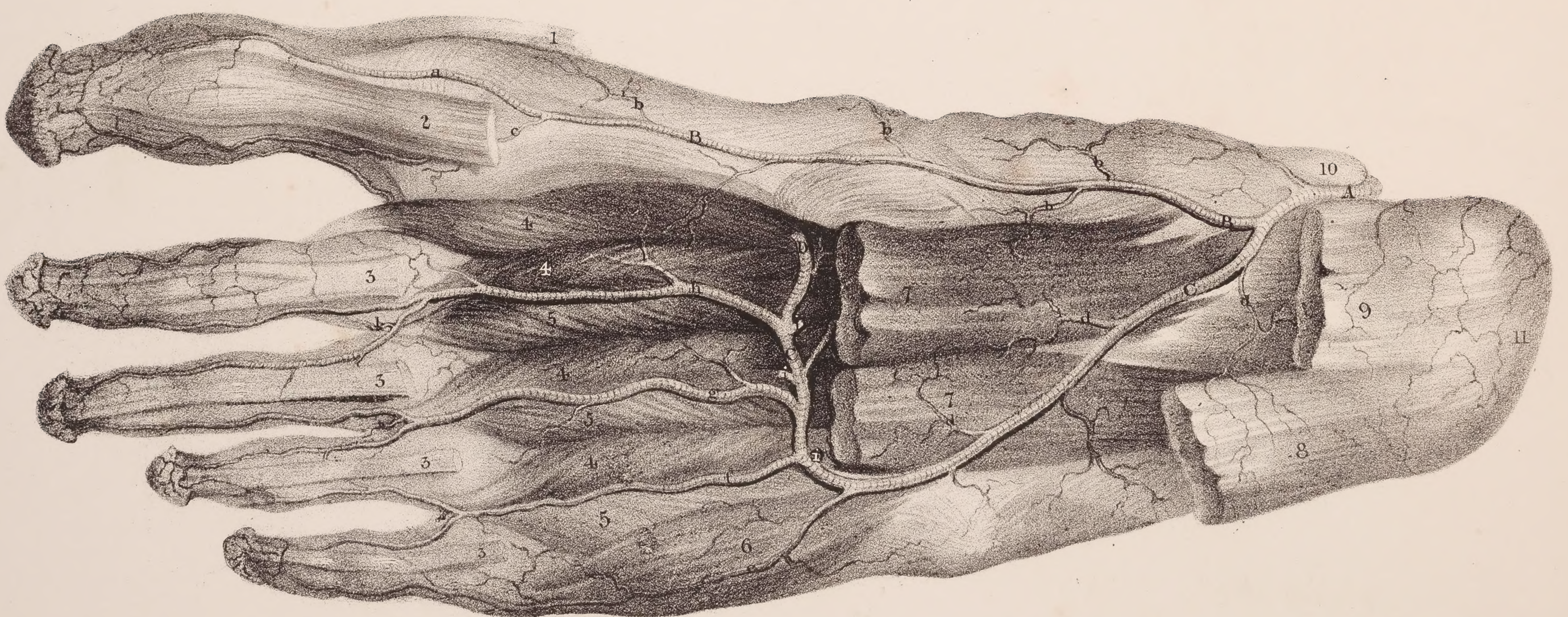


Fig. 2.



Varieties.—It may be observed, that considerable variety obtains in the mode of origin of the branches of arteries here described. Meckel justly observes, that the varieties in the arterial system are not less numerous than those of the venous, which is not generally supposed to be the case. But as these branches are intended to carry on the collateral circulation after the main vessel has been obliterated, their course and distribution are usually regular and uniform. The profunda artery very seldom comes off lower down than two inches from Poupart's ligament. Whenever it deviates from this rule, it, in the great majority of cases, separates from the femoral higher up, either close under the ligament, or even within the pelvis. In an individual who was the subject of popliteal aneurism, for which the usual operation was performed, it was found that the ligature when tied did not control the pulsation in the tumour; still a coagulum formed; but the patient died of another disease; and when the limb was dissected, two arteries, of nearly equal size, appeared, occupying the situation of the femoral. A division had taken place high up, and a reunion in the popliteal space just above the tumour. The preparation is preserved in the anatomical museum of the University of London. A similar conformation of the brachial artery has been already indicated. Meckel cites a case in which the femoral artery divided into the anterior and posterior tibial arteries at the top of the thigh at one side, the division being in its regular situation at the other.

PLATE XXXIII.

The arteries in the sole of the foot are here shown.

Fig. 1. In this dissection the plantar fascia has been removed with the flexor digitorum brevis muscle, and the deep fascia and cellular tissue which conceal the external plantar artery. The abductor pollicis muscle is drawn aside; the other muscles retain their natural position.

No. 1. The abductor pollicis muscle, the outer head is drawn to one side. 2, 2. The tendon of the flexor pollicis longus muscle. 3. Part of the flexor brevis pollicis muscle. 4. The tendon of the flexor digitorum longus dividing into four, for its attachment to the four lesser toes. 5, 5. The lumbricales muscles. 6, 6. Part of the transversus pedis muscle. 7. Interossei muscles. 8. Part of the flexor brevis digiti minimi. 9, 9. The abductor digiti minimi muscle. 10. The flexor accessorius muscle. 11. The divided origin of the flexor digitorum brevis. 12. The prominence of the internal malleolus of the tibia. 13. The os calcis.

A. The posterior tibial artery (a. tibialis postica) winding around the inner ankle. B. The internal plantar artery (a. plantaris interna). C, C. The external plantar artery (a. plantaris externa).

a. a. External superficial branches from the posterior tibial artery which anastomose with, b, b, branches of the peroneal and tarsal arteries. c, c. Internal superficial branches which communicate with branches of the internal malleolar artery. d, d. Muscular and superficial branches from the internal plantar artery. e. The termination of the internal plantar artery, forming the inner collateral branch of the great toe. f, f. Muscular and superficial branches from the external plantar artery. g. The fourth digital branch (r. digitalis quartus) of the plantar arch, supplying the outer side of the little toe. h. The third digital branch (r. digitalis tertius) dividing into collateral branches for the supply of the adjacent sides of the little and fourth toes. i. The second digital branch (r. digitalis secundus) distributed in like manner to the third and fourth toes; and, k, the first digital branch (r. digitalis primus) to the second and third toes. l. The digital branch which arises from the extremity of the dorsalis pedis artery in the sole of the foot.

Fig. 2. The superficial muscles being removed, the deep course of the plantar arteries is brought into view.

No. 1. The divided tendon of the abductor pollicis muscle. 2. The tendon of the flexor longus pollicis muscle. 3, 3. Tendons of the flexor brevis and longus digitorum muscles. 4, 4. The four dorsal interossei muscles. 5, 5. The three plantar interossei muscles. 6. The flexor brevis digiti minimi muscle. 7, 7. The flexor accessorius divided. 8. Part of the abductor digiti minimi. 9. The origin of the flexor brevis digitorum. 10. The prominence of the inner ankle. 11. The os calcis.

A. The posterior tibial artery. B, B. The internal plantar artery. C, C. The external plantar artery. D. The termination of the external plantar artery, dipping deeply between the two heads of the first dorsal interosseous muscle to inosculate with the communicating branch from the dorsal artery of the foot.

a. The termination of the internal plantar artery forming the first collateral branch of the great toe. b, b. Muscular and superficial branches. c. A small digital branch from the internal plantar artery to the outer side of the great toe. d, d. Muscular and superficial branches from the external plantar artery. e. The fourth digital branch from the plantar arch. f. The third digital branch. g. The second digital branch. h. The first digital branch. i, i. Posterior perforating branches (r. perforantes), which inosculate with corresponding branches from the metatarsal artery on the dorsum of the foot. k, k. Anterior perforating branches.

Fig. 3. Anomalous distribution of the arteries in the sole of the foot, in which the order of size and destination of the plantar arteries is nearly reversed; the internal plantar artery being the larger, and supplying two toes and one half of the third; the external, the smaller branch, ramifying only on the outer side of the little toe: the fourth and adjacent sides of the third and fifth being supplied by the communicating branch from the dorsal artery of the foot, which is so large as to form the plantar arch across the metatarsal bones.

The references are the same as those in Fig. 2.

a. The internal plantar artery. b. The external plantar artery. c. The communicating artery from the dorsalis pedis; immediately upon emerging in the foot it gives off, d, a large branch which unites with the internal plantar artery, and greatly augments its size.

Operations.—The femoral artery may be tied in the upper or middle third of the thigh; the former situation is now universally preferred, because the operation in the latter is considerably more difficult of execution, without securing any equivalent advantage. The limb being placed in the position pointed out at page 60, an incision is made through the integuments, beginning two inches below the middle point of Poupart's ligament, and carried perpendicularly downwards for three inches, or a little more, in a muscular fat subject. Previously to commencing this incision, it may not be amiss to place a scalpel, or a probe, along Poupart's ligament, and mark upon it the middle point; if the external end of the instrument be depressed, so that it should lie horizontally across the thigh, the incision through the integument should be made so as to form with the instrument thus placed a right angle. This suggestion is intended only for those who are about to perform the operation on the dead subject, or who may be planning the execution of it. The fascia lata being exposed, a small part of it should be pinched up with the forceps, and cut across, so as to form a small opening, into which a director is to be passed, in order that the fascia may be safely divided upon it. The sheath of the vessels is thus brought into view, a small part of which should be raised by the forceps, and divided, the knife being held in the horizontal position. The vein in this situation will be found behind, and a little to the inner side of the artery; on which account, in carrying the needle round the latter, its point is to be directed from within outwards, and cautiously insinuated between them, its surface being held close to the artery. Some difficulty is generally experienced in effecting this step of the operation. The point of the needle is said to be hitched on some tough cellular membrane, which is pushed onwards, and requires to be divided before the needle can be fairly protruded. This resistance is owing to the sheath of the vessels, now loose after its division, and readily caught into a fold by the point of the instrument. In operating on the dead subject, this impediment is readily removed, by pinching up the external flap of the sheath, and holding it tight with the forceps, whilst the needle is passed round the artery. The nerves, which here lie external to the sheath, will, by the same expedient, be held out of the way. The ligature of the carotid artery is facilitated by the same means. Would such a measure be advisable in operating on the living? It is not altogether undeserving of attention.

The Popliteal artery (plate XXVII. A, A; plate XXX. A, A; a. poplitea) is that part of the arterial trunk which extends from the opening in the adductor magnus to the lower border of the popliteus muscle, being continuous superiorly with the femoral, and inferiorly with the anterior and posterior tibial arteries, into which it divides.

Dissection.—The subject being turned on its face, an incision should be made through the skin, along the middle of the popliteal space, extending from the lower third of the thigh as far as the upper fourth of the leg, which corresponds with the length of the popliteal artery. A transverse incision should be made right across this at each extremity; the flaps thus marked out being reflected and the fascia exposed, this membrane is to be divided and reflected in the same manner. By these means the muscles bounding the popliteal space are exposed. The interval which they enclose is of a quadrilateral figure, two sides being formed by the hamstring muscles diverging to their insertions, and two by the heads of the gastrocnemius converging to their point of union. Through the centre of this space, from its superior to its inferior angle, runs the popliteal artery; but to expose it fully the mass of adipose matter by which it is concealed must be dissected away, in order that its relation to the vein and nerve may be clearly discerned. To follow it up in the superior part of its course, nothing more is necessary than to draw aside the flexor, or hamstring muscles, as they are merely connected by some cellular tissue, which retains them in apposition with one another. But as the lower part of the vessel is covered by the gastrocnemius, it will answer all purposes to divide the inner head of that muscle near the condyle, and then reflect and carry it outwards, which will expose it as far as its bifurcation.

The direction of the artery is downwards and a little outwards, running through the centre of the popliteal space. In this course the vessel rests on, or corresponds for some way to, the flat surface of the femur (a quantity of adipose substance interposing), then on the posterior surface of the knee-joint, and finally on the popliteus muscle. Its posterior surface is covered for some way by the semi-membranosus muscle; in the ham it is covered only by the skin, fascia lata, and a quantity of adipose matter in which it is embedded, but lower down it is concealed by the gastrocnemius. On either side of it lie the hamstring muscles above, and the heads of the gastrocnemius below. The artery is accompanied by the popliteal vein and the sciatic nerve, the vein being posterior and a little external to it, the nerve still more posterior and external, that is to say, lying nearer to the skin and to the head of the fibula. The popliteal artery gives off five articular branches, two above and two below

the joint, and one which passes into it,—also some large muscular branches to the gastrocnemius, hamstrings, &c.

The Muscular branches (plate XXVII. f, f, i, i, z, z; plate XXX. c, c; rami musculares) are superficial, and come distinctly into view, when the fascia is removed. Some of them are small, and are seen passing out at the point of divergence of the hamstring muscles; others, of considerable size, and three or four in number, will be observed between the heads of the gastrocnemius, two or three being distributed to its fleshy substance, and one rather long, and tapering in many cases, descends vertically in the middle line, resting on its posterior surface.

Articular branches (rami articulares).—Two of these pass away nearly at right angles from the popliteal artery above the flexure of the joint, and two below it; hence they are named internal and external.

Of the *superior pair*:—The *internal* branch (plate XXVII. a*; plate XXIX. fig. 1, b) turns round the inner side of the femur just above the condyle: and, passing under the tendon of the adductor magnus and vastus internus, divides into branches, of which one, comparatively superficial, enters the substance of the vastus, which it supplies, at the same time anastomosing with the r. anastomoticus, and with the inferior internal articular artery. The other branch runs close to the femur, gives ramusculi to it, also to the structures in the knee-joint, and keeps up a communication with the superior external articular artery. The *external* branch (plate XXVII. b*; plate XXIX. fig. 1, a) passes outwards, a little above the external condyle of the femur, crossing under cover of the biceps muscle, and divides into a superficial and deep branch; the latter keeps close to the femur, and, after giving ramusculi to it and to the articulation, anastomoses with the preceding and with the inferior articular branch; the former descends through the vastus to the patella.

Of the *inferior pair*:—The *internal* branch (plate XXVII. d*; plate XXIX. fig. 1, d) passes downwards and inwards below the corresponding tuberosity of the tibia, lying between the bone and the internal lateral ligament; its branches ramify on the anterior and inner part of the joint, as far as the patella and its ligament. The *external* one (plate XXVII. e*; plate XXIX. fig. 1, c) takes its course outwards under cover of the external head of the gastrocnemius in the first instance, and afterwards under the external lateral ligament of the knee, and the tendon of the biceps muscle; it thus reaches the fore part of the joint, and, near the border of the patella, divides into branches, of which one descends along the ligament of the patella to communicate with the inferior articular artery of the opposite side, and with the recurrent branch from the anterior tibial; the other ascends, and anastomoses with the superior articular arteries.

In a well-injected limb, the four articular branches form at the front and sides of the joint a complete mesh by their ramifications, all of which freely communicate with one another; and several of them may be traced into the substance of the bones through the foramina on their surface.

The middle or *azygos* branch (plate XXVII. c*) passes from the anterior surface of the popliteal artery, opposite the flexure of the joint, and about midway between the superior and inferior articular arteries; it pierces the posterior ligament of the joint, and divides into minute ramifications for the supply of the crucial ligaments and the other structures within the articulation.

The posterior Tibial artery (plate XXX. fig. 2, B, B; a. tibialis postica) is situated along the posterior part of the leg, between the superficial and deep muscles, being firmly bound down to the latter by the deep fascia.

Dissection.—When describing the method of exposing the popliteal artery, it was stated that this could be effected by merely dividing the inner head of the gastrocnemius, and turning the corresponding venter of it somewhat outwards. A small part of the posterior tibial artery, which is the continuation of the popliteal, is at the same time brought into view; but, as the rest of it lies deeply beneath the soleus, this muscle must be detached wholly or in part, in order to trace the course of the vessel. As the vessels are here bound down to the deep-seated muscles by the deep fascia, and as that membrane exerts an important influence on the progress of operations executed on these arteries, it is advisable to leave it untouched whilst the superficial muscles (those of the calf of the leg) are being removed. This end can only be attained with facility by proceeding with the dissection of the muscles from below upwards. An incision may with this view be made through the strong external fascia of the leg, along the borders of the tendo Achillis. If the tendon be then drawn backwards, and held on the stretch, the deep fascia will be readily exposed from the ankle as far as the belly of the soleus muscle. When this is effected, there can be no difficulty in detaching the muscular fibres from the tibia and fibula, as the fascia serves as a guide, indicating the line of separation between the superficial set of muscles which are to be removed, and the vessels and deep-seated muscles that are to be left untouched.

The posterior tibial artery extends from the lower border of the popliteus muscle, where it is continuous with the popliteal artery (of which it may be regarded as the continuation, from its direction and course), as far as the inner border of the calcaneum, where it terminates, by dividing into the plantar arteries. The course of the vessel is obliquely downwards and inwards, being placed above, midway between the bones of the leg, and below, between the inner ankle and the prominence of the heel. Its anterior surface rests successively on the tibialis posticus, the flexor longus digitorum, and inferiorly, for about two inches, on the tibia, separated from it by some cellular tissue; posteriorly, it is covered by the gastrocnemius and soleus (the deep fascia being interposed), and, farther down, by the fascia of the leg, as it is stretched from the tendo Achillis to the inner border of the tibia. On each side lie its accompanying veins, and along its external or fibular side runs the posterior tibial nerve. It will be recollected, that in the hollow between the internal malleolus and the calcaneum run three tendons, as well as the posterior tibial vessels. Their relative position may be stated as follows: the tibialis posticus and flexor longus digitorum run close to the inner malleolus; a quarter of an inch behind these is the tibial artery, the nerve being a little posterior to it; and finally, about half an inch further back towards the heel, is the tendon of the flexor longus pollicis. It gives off many branches:—

Muscular branches (plate XXX. fig. 2, k, k; r. musculares).—In its course along the leg, this artery gives several unnamed branches to the contiguous muscles, particularly to the tibialis posticus and the long flexors.

Nutritious artery (ramus nutritius tibiæ).—In the upper third of its extent, a considerable branch passes forwards to the tibia, and then, by an oblique course, through the nutritious foramen in that bone, reaches the medullary membrane, on which its branches ramify.

The chief branch of the posterior tibial is the following:—

The Peroneal artery (plate XXX. fig. 2, e, e; a. peronea) is situated deeply along the posterior part of the leg, taking the direction of the fibula; hence it is sometimes called *fibular*. It arises from the posterior tibial, from an inch to two inches below the lower border of the popliteus muscle, and descends almost perpendicularly towards the external ankle. Running for a while parallel and on the same plane with the posterior tibial artery, it lies on the tibialis posticus muscle, and is covered for the same distance by the soleus; as it descends, it inclines outwards to the fibula, and corresponds with the angle of union between it and the interosseous ligament. In this part of its course it is concealed from view by the flexor longus pollicis, to which it gives branches, as well as to the adjacent muscles, and also one to the substance of the fibula (*ramus nutritius fibulæ*). On reaching the lower extremity of the interosseous ligament, which is about two inches, or a little more, above the external ankle, the artery usually divides into two branches, named, from their situation, anterior and posterior peroneal.

Anterior Peroneal branch (plate XXX. fig. 1, g; fig. 2, i; plate XXXII. fig. 2, d, d; ramus peroneus anterior) passes forwards through the aperture in the interosseous ligament, and so reaches the fore part of the leg; it then descends along the border of the peroneus muscle, and sends branches outwards to the external ankle, which there anastomose with the external malleolar branch of the

PLATE XXXIV.

The arteries of the medulla spinalis.

Fig. 1. represents an anterior view of the medulla oblongata and spinal cord, with its cerebral attachments.

Nos. 1, 1. The crura cerebri. 2, 2. The pons Varolii. 3, 3. The fifth pair of nerves (n. trigemini) at either side. 4, 4. The sixth pair (n. abducentes). 5. The medulla oblongata. 6, 6. Filaments of origin of the hypo-glossal and glosso-pharyngeal nerves. 7, 7. Filaments of origin of the pneumo-gastric nerves. 8, 8. The nervus accessorius at each side. 9. The middle (humeral) swelling of the spinal cord. 10. The inferior (lumbar) swelling of the spinal cord. 11. The cauda equina.

A. A. The vertebral arteries (a. vertebrales). B. The basilar artery (a. basilaris).

a. a. The posterior cerebral arteries (a. posteriores cerebri). b, b. The superior cerebellar arteries (a. cerebelli superiores). c, c. Transverse branches to the cerebral protuberance. d, d. Inferior cerebellar arteries (a. inferiores cerebelli). e, e. Posterior spinal arteries (a. spinales posteriores). f, f. The anterior spinal artery (a. spinalis anterior) formed by the union of a small branch from either side. g, g. Bifurcations in the course of the anterior spinal artery, which afterwards reunite.

Fig. 2. A posterior view of the medulla spinalis, with its arteries.

Nos. 1, 1. The lateral lobes of the cerebellum. 2. The superior vermiform process.

a. a. The posterior spinal arteries (a. spinales posteriores) winding around the upper part of the medulla spinalis. b, b. Transverse branches of communication between the posterior spinal arteries.

Fig. 1.

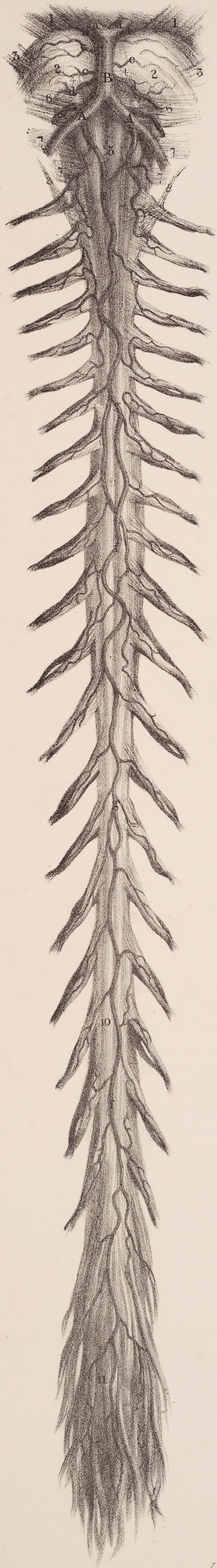
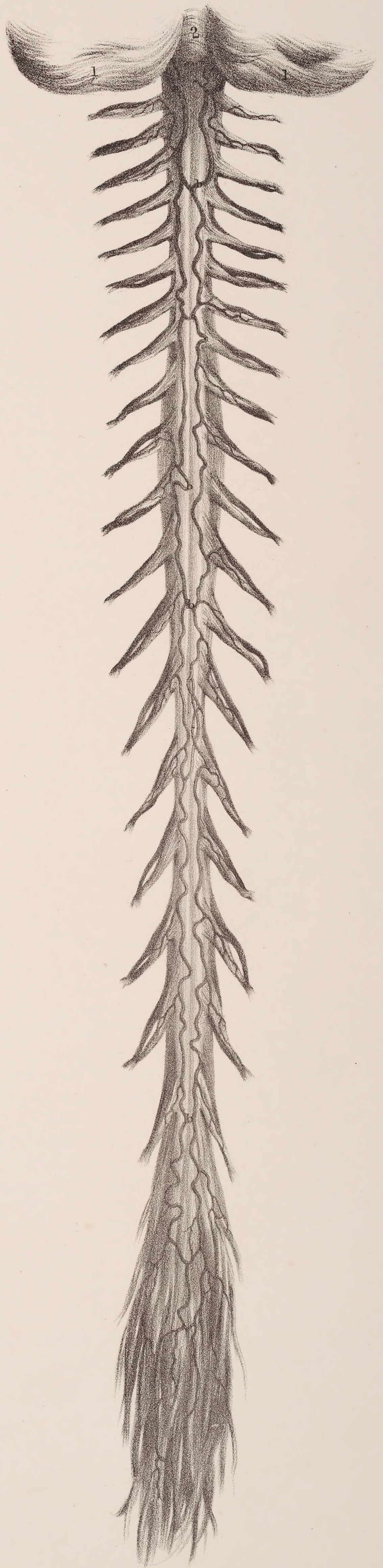


Plate 34.

Fig. 2.



anterior tibial, and some forwards on the dorsum of the foot, to communicate with the r. dorsalis pedis of the same artery. Some of its ramifications also extend to the outer border of the foot, where they communicate with the external plantar and posterior peroneal arteries.

The posterior Peroneal branch (plate XXX. fig. 1, f; fig. 2, g, h; plate XXXII. fig. 2, c, c; r. peroneus posterior) continues in the original course of the artery, running downwards behind the external ankle, to reach the outer surface of the calcaneum. On arriving at the latter situation, it divides into ramusculi, some of which pass backwards to anastomose with the posterior tibial artery, others downwards to the border of the foot, and terminate in the muscles of the little toe, the rest forwards on the tarsus, communicating with the anterior peroneal branch, and with the tarsal branches of the anterior tibial artery.

Varieties.—The size and distribution of the fibular artery vary considerably in different instances; in some the posterior tibial is wanting, the popliteal appearing to divide into anterior tibial and fibular, the latter being double its usual size. In such cases, when the vessel reaches the lower part of the leg, it sends inwards a considerable branch, which, taking the course of the posterior tibial artery round the inner ankle, terminates in the plantar branches. In other instances, the anterior tibial artery is very small, and its dorsal branch necessarily too diminutive to carry on the circulation on the foot. The anterior fibular branch is then of considerable size, and supplies its place.

Operations.—The posterior tibial artery, in the lower part of its course, where it runs in the depression between the inner ankle and the heel, can be exposed and secured without much difficulty. Towards the middle of this interval, but nearer the prominence of the inner ankle than that of the heel by a finger's breadth, the vessel may be observed to pulsate, if the foot be extended so as to relax the fascia and integuments. An incision should be made about two inches and a half in length, beginning near the inner border of the tendo Achillis, and extended downwards and forwards over the point just indicated. The integuments being thus divided, and the strong fascia of the leg exposed, it is in the next place to be laid open to the same extent, after which a deep fascia comes into view, being a continuation of that above-described as binding down the deep muscles and vessels. A small piece of this being pinched up by the points of the forceps, it is cut through so as to allow a director to be inserted beneath it, on which it is to be divided. The vessels are thus laid bare; so that the artery, after having been separated from the nerve and veins with the same precautions as in other situations, may be readily tied, the point of the needle being directed from below upwards and inwards towards the ankle, to avoid the nerve.

In the interval between the lower part of the calf of the leg and the inner ankle, the artery may be exposed in the following way: an incision should be made parallel with the inner border of the tendo Achillis for about the same length, and through the same structures (the skin and two layers of fascia) as in the preceding operation. This will bring the artery into view.

Few operations on arteries, probably none, present more difficulties than that of tying the posterior tibial while it is under cover of the soleus and gastrocnemius. The tibial origin of the former must be detached from the bone; and if, during this step of the operation, the deep fascia be torn, or the muscles rendered in any way confused, there remains no guide to the situation of the artery. In order to relax the muscles as much as possible, the knee must be slightly bent, and the foot extended so as to elevate the heel. If the limb be then placed on its outer side, and the knee supported, the seat of operation will be fairly brought into view. The incision through the skin must be very long, as the vessel lies so deeply; it may vary from four to five inches, according to the thickness of the muscles. It is usually directed to be made along the inner border of the tibia, so as to expose the margin of the gastrocnemius. In doing this the saphena vein can be easily avoided, as its course is quite apparent. When the soleus is exposed, its border is to be detached from the tibia, proceeding from below upwards, so as, if possible, to get a clear view of the deep fascia. If this be once obtained towards the lower part of the incision, a director can, without much difficulty, be insinuated between the membrane and the muscle, preparatory to the division of the fibres of the latter. When, by means of a retractor, the muscles are drawn back, so as to open the wound, its breadth will be found diminished by the posterior border of the incision in the integument; for it will be recollected that its direction coincided, in the first instance, with that of the border of the muscle where it is attached to the bone; but it will no longer do so when the muscle is drawn backwards. In other situations, where deep incisions are required, both margins of the wound can be held aside by the retractors, but here the posterior one only admits of their application, as the other coincides with the tibia. The necessity of some change in the line of the first incision is obviously suggested by these facts; and we believe that M. Lisfranc makes his incision rather obliquely, its

direction being from above downwards and backwards, so that, when the muscles are retracted, their border may coincide with that of the skin.

The Plantar arteries (plate XXXIII.)—When the posterior tibial artery reaches the hollow of the calcaneum, and gets under cover of the internal annular ligament, and of the origin of the abductor pollicis, it divides into the *plantar* arteries, which, from their position, are named internal and external.

The *dissection* of the plantar arteries includes that of the sole of the foot. When the thick skin and cellular texture are removed, and the plantar fascia fully exposed, the external plantar artery may be readily brought into view by cutting through a few fibres of the fascia, along the depression which separates the middle from the external portion of it; for when it has got on a line with the head of the fifth metatarsal bone, the vessel is almost superficial, though in the rest of its extent it is covered deeply by the muscles. The internal plantar artery can be laid bare merely by dividing the thin membrane which covers the abductor pollicis, and turning aside the external border of that muscle. When the plantar fascia and flexor brevis are detached and reflected from the calcaneum, the vessels can be easily traced in the rest of their extent.

The internal Plantar artery (plate XXXIII. figs. 1 and 2, B; a. plantaris interna), much smaller than the other, turns directly forwards, so as to form, when the body is in the erect position, a right angle with the vessel from which it arises. Placed at first above the abductor pollicis, and afterwards between it and the short flexor, it gives branches to both, and also some which incline towards the inner border of the foot, and communicate with branches of the dorsal arteries. On reaching the extremity of the first metatarsal bone, the internal plantar artery, considerably diminished in size, terminates by running along the inner border of the great toe, anastomosing with its digital branches. The direction of the artery corresponds with that of the line which separates the internal from the middle set of plantar muscles.

The external Plantar artery (plate XXXIII. figs. 1 and 2, C, C; a. plantaris externa), in size and direction, appears to be the continuation of the posterior tibial. In its course it at first inclines outwards and forwards, to reach the base of the fifth metatarsal bone, where it changes its direction, arching inwards across the foot, to gain the interval between the first and second metatarsal bones, where it receives the communicating branch from the dorsal artery, which completes the plantar arch. The vessel first passes between the calcaneum and the abductor pollicis, then between the flexor brevis digitorum and flexor accessorius; as it turns forwards it lies in the interval between the former muscle and the abductor of the little toe, corresponding with the line separating the middle from the external portion of the plantar fascia; but its transverse part is deeply covered by the flexors of the toes and the lumbricales. The convexity of the arch is directed forwards and outwards, the concavity in the opposite way, and from it are given off numerous branches, varying in size and importance. Of these some pass outwards over the border of the foot, and anastomose with the dorsal arteries; others go back to supply the parts in the hollow of the foot, and several down to the fascia, integument, and subcutaneous cellular substance; these are too irregular to admit of being named or described; but from its superior and anterior surfaces branches are given off which deserve notice:

Perforating branches (plate XXXIII. fig. 2, i, i; rami perforantes), three in number, pass upwards between the metatarsal bones, through the posterior extremities of the dorsal interosseous muscles, and, on reaching the dorsum of the foot, inosculate with the metatarsal arteries.

Digital branches (plate XXXIII. fig. 1, g, h, i, k; fig. 2, e, f, g, h; rami digitales) are four in number, and from the order in which they arise from the arch, counting from without inwards, they are commonly named first, second, &c.; but we shall name them from their relations to the metatarsal bones. The *fourth* digital branch curves outwards, to gain the external border of the fifth metatarsal bone; for it will be recollected that the most external part of the plantar arch corresponds with the fourth metatarsal space. In its course this vessel crosses under the abductor of the little toe, and then runs along the border of its phalanges, on the last of which it terminates; the *third* digital branch passes forwards along the fourth metatarsal space, and at the cleft between the toes divides into two twigs, which take the contiguous borders of the fifth and fourth toes, and end on the last phalanges; the *second* digital branch is similarly disposed of on the fourth and third toes; and the *first* on the third and second. Near the point of bifurcation, each digital artery sends upwards through the corresponding metatarsal space a small branch, which communicates with the digital branches of the metatarsal artery. These are called the *anterior perforating* branches (fig. 2, k, k), to distinguish them from those which come from the arch itself, and pass upwards between the posterior extremities of the metatarsal bones, to inosculate with the dorsal interosseous branches. The

digital arteries, which, from their relation to the phalanges, are sometimes called collateral, at their final termination incline towards one another, and form arches by inosculation, from the convexity of which minute vessels pass forwards to the extremities of the toes. It will be observed, that, in this way, both sides of the three outer toes, and one side of the second toe, are supplied by branches derived from the plantar arch, in the ordinary distribution of the vessels; whilst both collateral branches of the great toe, and the inner one of the second, are furnished by the dorsal artery.

The anterior Tibial artery (plate XXIX. A, A; a. tibialis antica) is placed along the fore part of the leg in the interosseous space, at first deeply seated, but as it descends it gradually becomes comparatively superficial; it extends from the division of the popliteal artery to the bend of the ankle, from which it is prolonged to the interval between the first and second metatarsal bones, under the name of *dorsal* artery.

Dissection.—The course of the anterior tibial artery, and that of its continuation, the a. dorsalis pedis, may be marked out by a line drawn from the inner border of the head of the fibula to the middle of the bend of the ankle, and thence continued onwards to the first metatarsal space. To expose the vessel, an incision should be made through the skin, corresponding with this line. Its commencement may, in the next place, be crossed by another, extending from the head of the fibula to the inner tuberosity of the tibia; a similar transverse incision is to be made at the ankle, and, to evert the skin conveniently, a third will be found necessary about midway. The flaps of integument being reflected, the one inwards on the tibia, the other outwards over the fibula, and the fascia exposed, the intervals between the muscles at once become apparent where their tendons shine through the fascia. This membrane should now be divided in the same extent and direction as the skin, and the artery will be brought into view by separating the muscles, which can be done without the least difficulty by proceeding from below upwards.

The dorsal artery, being placed between the tendon of the extensor proprius pollicis and that of the extensor communis, and uncovered by any structure except the skin and fascia, may be laid bare by an incision carried along the external or fibular border of the tendon of the extensor proprius, for about an inch and a half, or two inches. Above the bend of the ankle the incision must be somewhat longer, say two inches and a half, and the vessel will be found on the tibia, lying under the inner border of the extensor proprius.

The anterior tibial artery, at starting, turns horizontally forwards to reach the anterior surface of the interosseous ligament. In doing so, it necessarily passes between the heads of the tibialis posticus muscle, and through the interval between the bones left unclosed by the ligament. In its course it rests for two-thirds of its extent on the interosseous ligament, and for the rest on the anterior surface of the tibia. In the upper part of its extent it is deeply seated, and is overlapped and concealed by the tibialis anticus and extensor longus digitorum; the former being on its tibial, the latter on its fibular side. Lower down, it lies between the extensor pollicis and tibialis anticus; but, as towards the ankle these muscles incline inwards, the one to the tarsus, the other to the first metatarsal bone, whilst the artery continues directly onwards, it necessarily passes beneath the extensor pollicis, and is placed between the tendon of this muscle and that of the extensor communis digitorum. In this situation it is covered only by the skin and fascia of the leg. The anterior tibial artery is accompanied by two veins (*venæ comites*); the anterior tibial nerve lies to its fibular side for some way, as being derived from the peroneal nerve, it inclines inwards, so as to get in front of the artery in the middle of the leg, but turns outwards again as it descends lower down. Its branches are the following:

Muscular branches (plate XXIX. fig. 1, f, f; fig. 2, b, b; r. musculares).—Small muscular branches are given to the tibialis posticus, as it passes between its heads, and as it runs down the leg several branches pass off to the tibialis anticus, extensor communis digitorum, and extensor pollicis.

The Recurrent branch (plate XXIX. fig. 1, e; fig. 2, a; r. recurrens).—On reaching the front of the leg, it sends upwards a pretty large and regular branch called “recurrent,” because it is reflected up towards the knee from the point where the artery is turning downwards. This branch passes through the fibres of the tibialis anticus, and soon divides into several ramifications, which, on the lateral and fore parts of the knee-joint, anastomose with the inferior articular branches of the popliteal artery; and in its progress downwards, between the extensor muscles, it gives on each side several muscular branches.

Malleolar branches (plate XXIX. fig. 1, g, l; fig. 2, c, g; r. malleolares).—Near the ankle-joint two malleolar arteries are given off: the *internal* one, having passed beneath the tendon of the tibialis anticus, reaches the inner ankle, and ramifies upon it, supplying the surrounding textures, and com-

municating with branches of the posterior tibial artery; the *external* malleolar branch bears a similar relation to the outer ankle; having passed under the tendon of the common extensor, it anastomoses with the posterior peroneal artery, and also with some ascending or reflected branches from the tarsal artery.

The Dorsal artery of the Foot (plate XXIX. B, B; a. dorsalis pedis) is the continuation of the anterior tibial artery, extending from its termination at the bend of the ankle to the posterior extremity of the first metatarsal space, where it divides into two branches, of which one proceeds forwards in the first interosseous space, whilst the other dips into the sole of the foot, and terminates by inosculating with the plantar arch. Its course is forwards and inwards, running over the astragalus, the scaphoid, and internal cuneiform bones; it is covered by the skin and fascia, its line of direction corresponding with the interval between the tendons of the extensor proprius pollicis and extensor communis. The principal branches of the dorsal artery are directed outwards and forwards upon the tarsus and metatarsus, and are named accordingly. Some small vessels also run obliquely inwards upon the inner side of the foot, where they terminate in minute ramusculi.

The Tarsal branch (plate XXIX. fig. 1, m; fig. 2, k; ramus tarseus) arises from the artery usually where it crosses the scaphoid bone, but its point of origin varies in different instances. It inclines forwards and outwards, describing a slight curve as it runs upon the tarsal bones covered by the extensor brevis muscle, to which it gives ramusculi; some also, of small size, sink deeply into the tarsal articulations, for the nutrition of the different structures which compose them. The artery, having curved backwards to the cuboid bone, divides into branches which take different directions; some forwards, to anastomose with the divisions of the metatarsal artery; others outwards, to communicate at the border of the foot with branches of the external plantar artery; whilst a third set anastomoses with branches of the external malleolar, and with those which the fibular gives to the outside of the calcaneum.

The Metatarsal branch (plate XXIX. fig. 2, m, m; r. metatarsus) is usually smaller than the preceding, and comes off farther forward. Its direction is also outwards and forward under the extensor brevis. Sometimes there are two metatarsal arteries, the second being of smaller size, and, not unfrequently, when there is but a single vessel of this name, it arises in common with the tarsal artery. Its direction is necessarily influenced by these circumstances, being oblique when it arises far back, and almost transverse when its origin is situated farther forwards than usual. Ramusculi pass off in different directions for the supply of the surrounding structures; and some curve backwards, to form anastomoses with those of the tarsal artery; the interossei only deserve notice.

Interosseous branches (plate XXIX. fig. 1, s, s; fig. 2, n, n; r. interossei).—These branches are named “interosseous” from their position between the metatarsal bones. These are small straight vessels which pass forwards, resting each upon one of the dorsal interosseous muscles, and at the cleft between the toes each divides into two ramusculi which run along the contiguous borders of the toes, forming their dorsal collateral branches (fig. 2, o, o). From the external interosseous artery a small branch is given off, which inclines outwards to gain the external border of the little toe, upon which it lies, forming its first collateral branch. In this way we find that the interosseous branches derived from the metatarsal supply the dorsal surfaces of the three outer toes, and one side of the second. Now each of these vessels at its point of bifurcation communicates with the plantar artery by means of the anterior perforating branches; and again, at the posterior extremity of the interosseous spaces, they receive the posterior perforating branches (fig. 2, p, p). These are usually small branches of communication; but sometimes they are of larger size, and, on reaching the upper surface of the foot, form the interosseous arteries, the metatarsal branches being reduced to small ramusculi, which terminate in them.

When the dorsal artery of the foot has reached the posterior extremity of the first metatarsal space, it gives off a branch which runs along the outer surface of the first metatarsal bone, and which, from its analogy to the interosseous branches derived from the metatarsal artery, may be called the first interosseous branch, but is commonly called *r. dorsalis pollicis*, (fig. 1, q; fig. 2, t,) for, on reaching the fissure between the toes, it divides so as to form a collateral branch for the inner side of the second, and for the outer side of the great toe.

The artery, after giving off this branch, dips into the first interosseous space, and divides into its two ultimate branches. One of these (fig. 2, s), about two or three lines in length, inclines outwards, and terminates by inosculating with the external plantar artery, so as to complete its arch; the other passes forwards beneath the outer border of the first metatarsal bone, towards the fore part of which it sends inwards a branch which becomes the internal collateral branch of the great toe; after which,

on reaching the anterior extremity of the first metatarsal space, it divides into branches which run along the contiguous borders of the first and second toes.

The arteries of the foot are subject to several variations, and none so much so as those of the great toe. When the dorsal artery is small, the digital branches at the plantar surface of the great toe are derived from the vessels in the sole of the foot. When the interosseous branches of the metatarsal artery are small, their place is supplied by the posterior perforating arteries.

Anastomoses.—We have made frequent mention of the anastomoses between the different branches of the arteries in the lower extremity. It now becomes necessary to take a general view of them, in order that we may understand the important influence they exert in maintaining the circulation in the limb, when the principal artery is obliterated by an operation, or by disease. It will be recollected, that branches from different directions converge towards the posterior part of the hip-joint. The circumflex arteries (internal and external) turn round the shaft of the femur, one from within, the other from without; the gluteal and ischiadic arteries run from above downwards, and the superior perforating branches from below upwards, towards the same point. So that if the supply from one quarter be diminished or cut off, the loss is speedily made up from some other, the vessels taking on an increase of size and action proportioned to the increased demand upon them. This may be termed the *ilio-femoral anastomosis*. At the anterior and upper part of the limb, a similar mode of connexion occurs, but by no means so extensive, between the ilio-lumbar artery and the circumflex ilii, and again between the latter and the external circumflex on the one hand, and the epigastric on the other.

Round the knee-joint a very free communication exists between the four articular arteries (converging to its fore part) and the recurrent tibial from below, and the descending branches of the external circumflex, from the opposite direction. This may be named the *femoro-tibial anastomosis*; and if we examine the condition of the vessels in a well-injected limb, we shall find it connected with the ilio-femoral anastomosis by the descending branches of the external circumflex artery in front, and by the series of perforating branches behind.

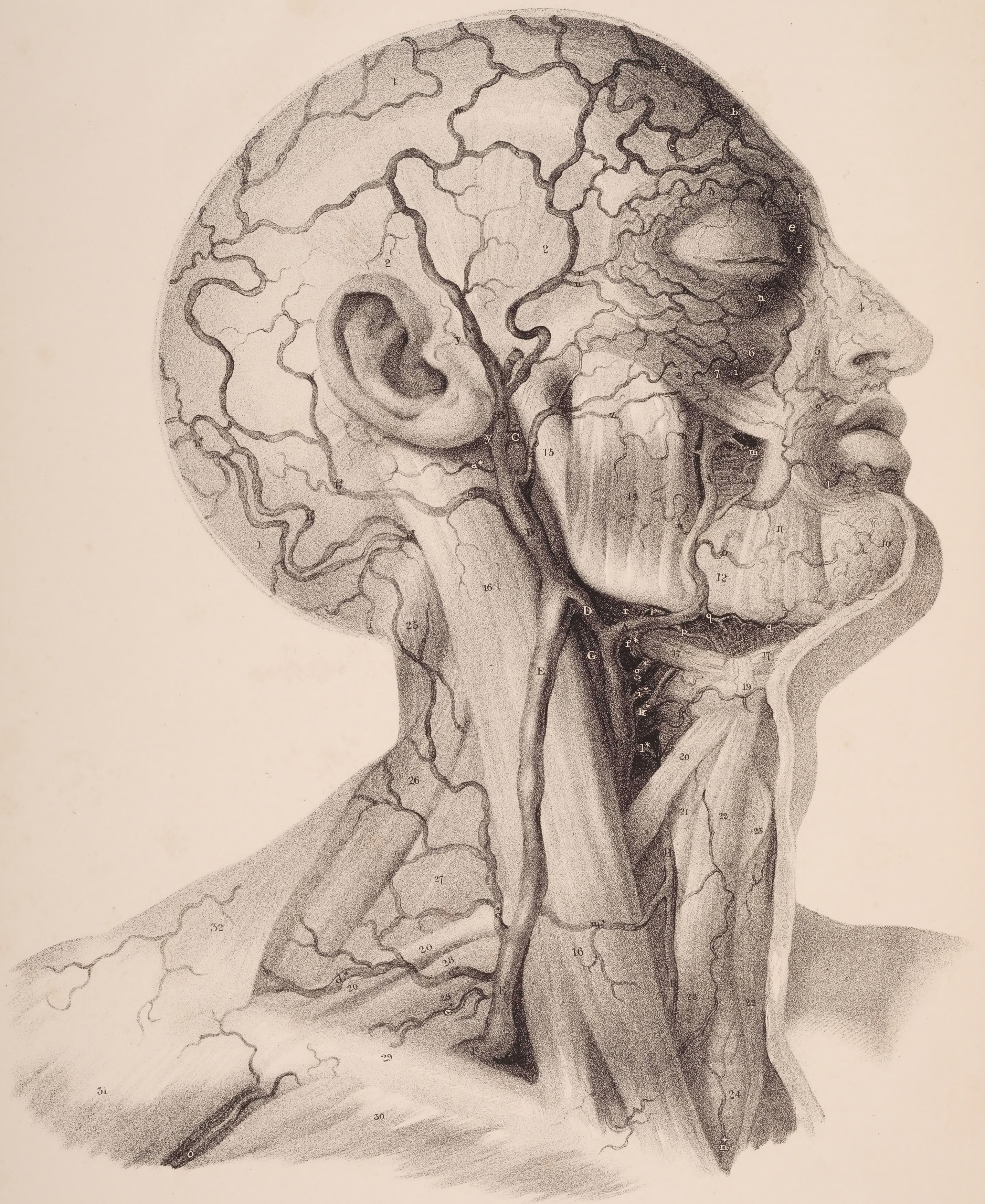
The ankle-joint is surrounded by a corresponding distribution of vessels. The posterior tibial artery and the peroneal communicate before they proceed to their final destination. In front of the joint, the anterior peroneal branch anastomoses with the tarsal and external malleolar arteries; the latter communicating again with the posterior fibular, whilst the internal malleolar maintains a similar relation with the posterior tibial, or its branches. This forms the *tibio-tarsal anastomosis*.

This freedom of anastomosis between the capillary terminations of different vessels, may be considered as a provision against the consequences that must otherwise follow the obliteration of any of the main vessels of a limb by an injury or by operation. If the external iliac artery is tied for an aneurism high up in the thigh, an increased quantity of blood is at once thrown on the internal iliac artery and its branches, which thus become distended and enlarged. Whilst this is taking place, the femoral artery and its branches empty themselves of their blood, forcing it on into the veins by their contractile power, at the same time that they receive none in their natural course. But after a while they become filled again, and circulate blood, though in a direction exactly opposite to that in which it had previously flowed in them. The capillary terminations of the circumflex arteries receive from those of the gluteal, sciatic, and obturator, the increased current, which is thrown upon them, and convey it thus into the femoral artery below the tumour for which the operation was performed; and so, in the new order of things, the blood flows from branch to trunk, conducted through the devious route of the collateral vessels, and maintaining the vitality of the limb by what is termed the *collateral circulation*. The anterior and lateral parts of the abdominal parietes, it will be recollected, are supplied by the epigastric and circumflex ilii arteries. When the regular source of their supply is cut off by the obstruction in the iliac artery, gangrene would speedily supervene if the circulation were not restored from some other quarter. A recurrence to the anastomoses of these vessels at once reminds us, that the circumflex ilii artery communicates with the epigastric on the one hand, and the ilio-lumbar on the other, and forms a ready medium of communication between them, when the latter, after the application of the ligature, receives part of the increased current propelled into the internal iliac artery, from which it arises. We need not extend these remarks farther for the present. The anastomoses round the knee and ankle must be sufficiently obvious from what has been already stated. As, however, the subject is one, not only of deep interest, but of great consequence in a practical point of view, we can scarcely refrain from raising this question, What is the condition of the vessels of a limb which has been the subject of an operation for aneurism? We reply in the words of an eminent authority: "In twelve or fourteen months after a ligature has been

applied on the femoral artery, it becomes completely obliterated, as far up as the profunda, and down to the origin of the anterior tibial artery, the remnant of the vessel being a mere cord. The circumflex vessels become enlarged, and convey blood to the rectus, sartorius, and vasti, which had previously been supplied by the femoral. The articular arteries round the knee are also enlarged and tortuous; they receive blood, not from the popliteal, but from the communicating vessels of the profunda." After some general remarks on the effect of ligatures, the description of the limb, which formed the subject of the memoir here referred to, proceeds as follows: "The profunda, which formed the new channel for the blood, was considerably enlarged in diameter, and sent branches larger than usual to the flexor muscles. Just midway on the back part of the thigh, it gave off those branches which became the chief support of the new circulation. The first of the newly-established vessels went down to communicate with the superior articular artery, on the inner side of the articulation. Another, guided by the biceps muscle, opened into a muscular branch on the gastrocnemius. Between these, a third vessel, passing along in the course of the sciatic nerve, divided into several branches, communicating with the inferior articular vessels, with the origin of the anterior and posterior tibial arteries, and with some of their muscular branches, in such a way as to form a vascular plexus in the popliteal space. The external circumflex artery was considerably enlarged, and freely supplied the muscles on the fore part of the thigh. The obturator artery did not appear larger than usual, nor could any enlarged communicating branches be traced between the ischiadic and profunda arteries."*

* Dissection of an Aneurismal Limb, by Sir Astley Cooper. Med. Chir. Trans. vol. ii.

Plate 35.



W. J. E. Wilson inv.

J. Swandale del.

Wm Fairland, lith.

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CHAPTER II.

OF THE VEINS.

THOUGH the veins diffused throughout the body form one system, and serve for one especial purpose—that of returning the effete or residual blood to one common recipient (the right auricle) by means of their great trunks (*venæ cavæ*), still they admit of a division into compartments, in consideration of certain peculiarities which they present. The veins within the cavity of the cranium and spine form a group, in a manner apart from the others; so does the *vena portarum*, which ramifies in the liver; and perhaps the pulmonary veins may be admitted as a third, from the circumstance of their conveying red blood. Even before the announcement of Harvey's discoveries, anatomists per-

PLATE XXXV.

The veins on the external surface of the head and face, with the superficial veins of the neck, are here shown.

The arteries are removed lest any ambiguity might arise from the association of the two sets of tubes.

Nos. 1, 1. The occipito-frontalis muscle. 2, 2. The aponeurosis which conceals the temporal muscle. 3, 3. The orbicularis palpebrarum muscle. 4. The compressor narium. 5. The levator labii superioris alæque nasi. 6. The levator labii superioris proprius. 7. The zygomaticus minor muscle. 8. The zygomaticus major. 9, 9. The orbicularis oris muscle. 10. The depressor labii inferioris. 11. The depressor anguli oris. 12. The body of the inferior maxillary bone. 13. The buccinator muscle. 14, 14. The masseter muscle. 15. The ramus of the inferior maxillary bone. 16, 16. The sterno-mastoid muscle. 17, 17. The digastricus muscle. 18. The mylo-hyoideus muscle. 19. The body of the os hyoides. 20, 20. The omohyoideus muscle. 21. Part of the thyro-hyoideus muscle. 22, 22. The sterno-hyoideus muscle, at each side. 23. The projection of the thyroid cartilage. 24. The trachea. 25. The splenius muscle. 26. The levator anguli scapulæ muscle. 27. The posterior scalenus muscle. 28, 28. The lower cervical nerves, descending to form the brachial plexus. 29. The clavicle. 30. Part of the pectoralis major muscle. 31. Part of the deltoid. 32. The trapezius muscle.

A, A. The facial vein (*vena facialis*).

a, a. The frontal vein (*v. frontalis*). b, b. Transverse branches by means of which this vein communicates with its fellow of the opposite side. c. A branch of the frontal, which dips beneath the orbicularis palpebrarum muscle to communicate with a deep supra-orbital branch. d. The supra-orbital vein (*v. supra-orbitalis*). e, e. The angular vein (*v. angularis*). f, f. Nasal veins opening into the angular. g. Superior palpebral vein. h, h. Some small veins ramifying around the lower eyelid. i. The inferior palpebral vein (*v. palpebralis inferior*). k. The superior coronary vein. l. The inferior coronary vein. m, m. Buccal veins (*v. buccales*). n, n. Masseteric veins. o, o. The inferior labial vein. p, p. The ranine vein (*v. ranina*). q, q. The submental vein (*v. submental*). r. The inferior palatine vein (*v. palatina*).

B, B. The temporal vein (*vena temporalis*).

s, s. The anterior temporal vein (*v. temporalis anterior*). t. A branch of the temporal vein communicating with the same vein on the opposite side of the head. u, u. External palpebral veins opening into the anterior temporal. w, w. The posterior temporal vein (*v. temporalis posterior*). x. The middle temporal vein (*v. temporalis media*). y, y. Anterior auricular veins (*v. auriculares anteriores*). z, z. The transverse vein of the face (*v. transversalis faciei*). a*. The posterior auricular vein (*v. auricularis posterior*).

C. The internal maxillary vein (*v. maxillaris interna*). To expose this vein, the small branches from the parotid gland (*v. parotidæ*), and from the articulation of the lower jaw (*v. articularis*), have been removed. D. The anterior terminal branch of the temporal vein inclining inwards to join the facial vein. E, E. The external jugular vein (*v. jugularis externa*).

b*. The mastoid vein, which generally descends to open into the external jugular vein. c*. A muscular and superficial trunk from the back part of the neck. d*, d*. The posterior scapular vein (*v. posterior scapulæ*). e*. The supra-scapular vein (*v. supra-scapularis*).

F. The upper border of the subclavian vein (*vena subclavia*). G, G. The internal jugular vein (*vena jugularis interna*).

f*. The pharyngeal vein (*v. pharyngea*). g*. The lingual vein (*v. lingualis*). h*, h*. The occipital vein (*v. occipitalis*). i*. The laryngeal vein (*v. laryngea*). k*. The superior thyroid vein (*v. thyroidea superior*). l*. The middle thyroid vein (*v. thyroidea media*).

H, H. The anterior jugular vein (*vena jugularis anterior*).

m*. A communicating branch passing between the anterior and middle jugular veins, which receives some superficial veins from the fore part of the neck (*v. cutaneæ*). n*. An inferior thyroid vein (*v. thyroidea inferior*). o*. The termination of the cephalic vein.

ceived how objectionable it was to classify these vessels with other veins, and sought to mark the distinction between them, by calling them *arteriæ venosæ*; and for the like reason, the pulmonary artery was named *vena arteriosa*.

We shall commence our description of the veins with those which form the superior vena cava, or more properly, with those which, commencing by minute ramusculi in the head, neck, the upper extremities, and the walls of the thorax, form so many tributary streams, gradually increasing in size as they diminish in number, until they are finally united into one current, that of the superior vena cava. The cerebro-spinal veins may be considered an offset connected with this part of the venous system, as their contents are, for the most part, poured into it. The venous ramifications, which terminate in the inferior vena cava, come next in order; to this the vena portarum is an adjunct. The veins of the heart open directly into the right auricle itself, and so cannot be said to belong to either venous trunk; the vena azygos (major and minor) is a tributary to the superior vena cava, at the same time that it serves as a substitute for both these vessels within the thorax, and also as a medium of connexion between them.

The veins of the head are divided, like the arteries, into two sets,—those which ramify on its exterior, and those placed in its interior; and a sufficient correspondence exists between the ramifications of both orders of vessels to warrant us in saying generally, that the one returns the residue of the blood circulated by the external carotid artery, the other by the internal. The veins on the exterior of the head converge and unite, so as to form two trunks, the facial and the temporal.

The Facial vein.—The facial vein (plate XXXV. A; vena facialis) lies obliquely along the side of the face, extending from the inner margin of the orbit downwards and backwards to the anterior edge of the masseter muscle. Resting on the same plane as the facial artery, but farther back, and less tortuous, it still maintains very nearly the same relations. It may be said to commence at the side of the root of the nose by a vein formed by the conflux of branches from the forehead, the eyebrow, and nose, and to increase by receiving others at each step of its course.

The Frontal vein (plate XXXV. a, a; vena frontalis) commences on the roof of the skull by ramusculi, which pass obliquely downwards and forwards upon the forehead, maintaining communications in their course with the anterior branches of the temporal vein. By gradually converging, these branches form a vein of some size, which descends vertically, parallel with the corresponding vessel of the opposite side, with which it is connected by transverse branches. In some instances both unite and form a short trunk, which again divides at the root of the nose, its branches diverging as they descend, so as to become continuous with the angular vein. When descending from the forehead, it receives a branch from the eyebrow, and some, of smaller size, from the nose and upper eyelid.

The Supra-orbital vein (plate XXXV. d: vena supra-orbitalis; v. supercilii) runs transversely inwards in the direction of the eyebrow, covered by the occipito-frontalis muscle. Its radicles are connected externally with those of the external palpebral and superficial temporal veins; in its course it receives branches from the contiguous muscles and tegument, and at the inner angle of the orbit it inclines downwards, to terminate in the frontal vein. The supra-orbital and frontal veins, by their junction, form the angular vein (*vena angularis*; plate XXXV. e, e), which is perceptible beneath the skin as it runs obliquely downwards and outwards by the inner margin of the orbit, resting against the side of the root of the nose. This small vessel receives by its inner side the *nasal veins* (f, f), which pass upwards obliquely to join it from the side and ridge of the nose; whilst some small palpebral veins open into it from the opposite direction. When arrived on a level with the lower margin of the orbit, the angular vein may be said to terminate by becoming continuous with the facial vein.

The facial vein, commencing as has been just stated, gradually increases, by receiving ramusculi from the lower eyelid (h), and from the ala of the nose; also from the upper lip branches arise which, after a short course, open into it. By its outer side it receives a vein (*v. palpebralis inferior, externa*; i), which is formed by small branches derived from the lower eye-lid, from the external side of the orbit, and the prominence of the cheek. The direction of this vessel is obliquely inwards above the zygomaticus muscle, beneath which it turns previously to its termination. When on a level with the angle of the mouth, the facial vein is further increased by branches from the lips, which perhaps may be called coronary veins (k, l), and from the cheek (*venæ buccales*; m, m), and still lower down from the masseter muscle (n, n) on the one hand, and the chin (o) on the other. When arrived at the lower border of the jaw, the vein inclines outwards and backwards, covered by the cervical fascia and the platysma muscle, and soon unites with a large branch of communication derived from the temporal vein (D), to form a vessel of considerable size, which opens, at an acute angle, into the trunk of the internal jugular vein.

Previously to its termination, the facial vein receives the following veins:—viz. *vena ranina* (p, p), a small vessel which lies along the under surface of the tongue, close by the frænum linguæ, in apposition with the artery of the same name; its course is backwards and outwards, between the mylo-hyoideus and hyo-glossus muscles, to open into the facial vein, or sometimes into the lingual:—*vena submentalis* (q, q); this vessel, larger than the preceding, commences by radicles derived from the sublingual gland, from which it passes backwards in the course of the duct; it receives branches from the submaxillary gland, and from the mylo-hyoideus muscles, and, keeping close under cover of the margin of the jaw-bone, it joins the facial vein; but in some instances it pours its contents into the lingual or superior thyroid vein. *Vena palatina* (r) returns the blood from the amygdala and soft palate; it passes downwards, deeply seated by the side of the pharynx, to join one of the preceding veins, or terminate in the facial separately.

The Temporal vein (plate XXXV. B; *vena temporalis*) is a vessel of considerable size, whose trunk passes almost perpendicularly downwards before the external auditory tube, extending from the zygoma, upon which it rests, to the angle of the jaw, whilst its branches spread out upon the side of the head, some being superficial, others deeply seated. The superficial branches commence by minute ramifications upon the arch of the skull, where they communicate with the radicles of the frontal and occipital veins, as well as with those of the corresponding vein of the opposite side. That from the fore part (*v. temporalis anterior*; s, s) inclines downwards and a little backwards, the vein seated posteriorly (*v. temporalis posterior*; w, w) runs forwards over the ear, both being placed between the skin and the temporal fascia. Converging in this way, they unite at an angle above the zygoma, and at their junction commences the trunk of the temporal vein. To this same point also passes a large branch, which may be called the middle temporal vein (*v. temporalis media*; x), to distinguish it from those which are still deeper seated, and open into the internal maxillary vein. This vessel arises in the substance of the temporal muscle, from which the branches emerge, and form a vessel of some size upon its surface; the vessel pierces the fascia at the upper border of the zygoma, and opens into the commencement of the common trunk, formed as has been above stated. The temporal vein gradually sinks into the substance of the parotid gland as it descends behind the ramus of the jaw. When under cover of its angle, it divides into two vessels, of which one, ordinarily the larger, inclines inwards to join with the facial vein, whilst the other turns backwards, and becomes continuous with the external jugular vein. The branches which open into the temporal vein in its course are numerous:—from the parotid gland several ramusculi (*venæ parotideæ*), from the articulation of the jaw (*vena articularis*), from the external ear (*venæ auriculares*; y, y), from the side of the face a vein of some size (*vena transversalis faciei*; z, z). This vessel corresponds with the artery of the same name, by receiving branches from the parts it supplies. Its direction is transversely outwards from the side of the face to the temporal vein. From the opposite direction is received the *vena auricularis posterior* (a*), which is increased by the stylo-mastoid vein. Besides these, a vein of considerable size joins the temporal whilst embedded in the parotid gland, viz. the internal maxillary vein:—

The Internal Maxillary vein (plate XXXV. C; *vena maxillaris interna*) corresponds in direction, position, and relations, with the artery of the same name. Three or four temporal branches descend from the fossa, deeply seated; others come from the pterygoid muscles; some from the surface of the upper jaw; and one, of large size, from the lower one, emerging from the dental foramen (*vena dentalis inferior*). All these unite to form a short trunk, which joins nearly at right angles with the temporal vein.

External Jugular vein (plate XXXV. E, E: *vena jugularis externa*; trachelo-subcutanea).—This vein commences on a level with the angle of the jaw by the junction of two branches; one the communicating branch received from the termination of the temporal vein, the other derived from the mastoid region. The latter (b*, b*) passes downwards and forwards obliquely to the point above stated, from behind the ear, resting on the mastoid muscle. The external jugular vein assumes at once the perpendicular direction, lying between the platysma and sterno-mastoid. In consequence of the obliquity of the muscle last named, the vein gets to its outer border, close by which it descends to the lower part of the neck, where it inclines inwards behind the muscle, to terminate (either as a single trunk, or by two or three branches) in the subclavian vein (F) near its junction with the internal jugular. In this course it receives one or two large branches from the back of the neck; one of them (c*), lying at first between the splenius and trapezius, passes down at the outside of the jugular vein, and about the middle of the neck opens into it. Some superficial branches also join it from the fore part of the neck (*venæ cutaneæ*; m*). Some of these commence over the submaxillary gland, some under the chin; by converging, they form a vein, often of considerable size (*v. jugularis*

anterior ; H), which lies along the inner border of the sterno-mastoid muscle, receives some cutaneous branches lower down, and then inclines outwards to terminate in the external jugular vein. Previously to its termination two large veins open into it, derived from the region of the scapula (*vena supra-scapularis*, e* ; et *vena posterior scapulae*, d*). Their direction is transverse from without inwards, lying parallel with the arteries of the same.

Internal Jugular vein (plate XXXV. G, G ; plate XXXVII. B, B : *vena jugularis interna*).—The blood from the brain and cranial cavity is received by the internal jugular veins, which are continuous at their upper extremities with the lateral sinuses ; whilst inferiorly, they terminate in the brachio-cephalic veins. The junction of the vein with the sinus is at the broad part of the foramen lacerum (*fossa jugularis*), beneath which it is supported by the rectus lateralis muscle, and lies close at the outer side of the internal carotid artery, as far as the cornu of the os hyoides. Now, as the part of

PLATE XXXVI.

The veins of the upper extremity are here shown.

Fig. 1. Portions of the fascia have been removed from the upper arm, fore-arm, and hand, for the purpose of exhibiting the deep vessels.

No. 1. The deltoid muscle veiled by a thin fascia. 2. The pectoralis muscle seen through the fascia. 3. The fascia covering the biceps muscle. 4. The boundary of the incision made to remove the fascia from over the brachial artery. 5. The inner edge of the biceps and coraco-brachialis muscles. 6. The triceps. 7. The process of fascia sent inwards over the flexor muscles by the tendon of the biceps. 8. The prominence made by the supinator longus muscle. 9. The prominent outline of the pronator radii teres. 10, 11. The outlines of the flexor carpi radialis and palmaris longus muscles. 12. The situation of the flexor carpi ulnaris. 13. The divided edge of the fascia of the fore-arm. 14. The tendon of the supinator longus muscle. 15. The tendons of the flexor muscles surrounded by a cellular sheath. 16. The tendon of the palmaris longus. 17. The tendon of the flexor carpi ulnaris. 18. The annular ligament. 19. The muscles forming the ball of the thumb covered by fascia. 20, 20. The tendons of the superficial flexor muscle. 21, 21. The fascia surrounding the fingers.

A, A. The radial cutaneous vein (*v. radialis cutanea*). B, B. The cephalic vein (*v. cephalica*).

a, a. Branches ramifying around the back part of the thumb and fore-finger, which unite to form the commencement of the radial cutaneous vein. b, b. Branches from the posterior aspect of the fore-arm. c, c. Branches from the anterior surface of the fore-arm. These last maintain a communication also with the median and ulnar veins.

C, C. The anterior ulnar cutaneous vein (*v. ulnaris cutanea anterior*). D. The posterior ulnar cutaneous vein (*v. ulnaris cutanea posterior*). E, E. The basilic, piercing the fascia of the upper arm to terminate in the axillary vein.

d, d. Branches of origin of the anterior ulnar cutaneous vein. e, e. Branches of communication with the posterior ulnar cutaneous. f. Branch of communication with the median vein.

F. The median vein (*v. mediana*). G. The median basilic vein (*v. mediana basilica*). H. The median cephalic vein (*v. mediana-cephalica*).

g. The deep median branch of communication with the deep brachial veins.

The deep veins :—

h, h. Digital veins formed by the union of the collateral branches from the sides of the fingers. i, i. Accompanying veins (*v. comites*) of the superficial palmar arch. k, k. Accompanying veins of the ulnar artery (*v. comites arteriæ ulnaris*), communicating with each other by means of transverse branches. l, l. Accompanying veins of the radial artery (*v. comites arteriæ radialis*). m, m. Accompanying veins of the brachial artery (*v. comites arteriæ brachialis*).

I. The axillary vein (*v. axillaris*).

Fig. 2. The superficial veins on the posterior aspect of the fore-arm and hand.

No. 1. The fascia covering the lower part of the triceps muscle. 2. The prominence of the olecranon. 3. The convexity formed by the supinator longus and extensor carpi radialis longior muscles. 4. The outline of the anconeus muscle seen through the fascia. 5, 6, 7. The outlines formed by the projection of the extensor carpi radialis brevior, extensor communis digitorum, and extensor carpi ulnaris muscles. 8. The prominence of the lower extremity of the ulna. 9. The posterior annular ligament. 10. The swelling of the extensores ossis metacarpi and primi internodii muscles. 11. The projection of the styloid process of the radius. 12. The fascia covering the back part of the hand. 13. That covering the muscles of the little finger.

A, A. The radial cutaneous vein (*v. radialis cutanea*). B, B. The posterior ulnar cutaneous vein (*v. ulnaris cutanea posterior*).

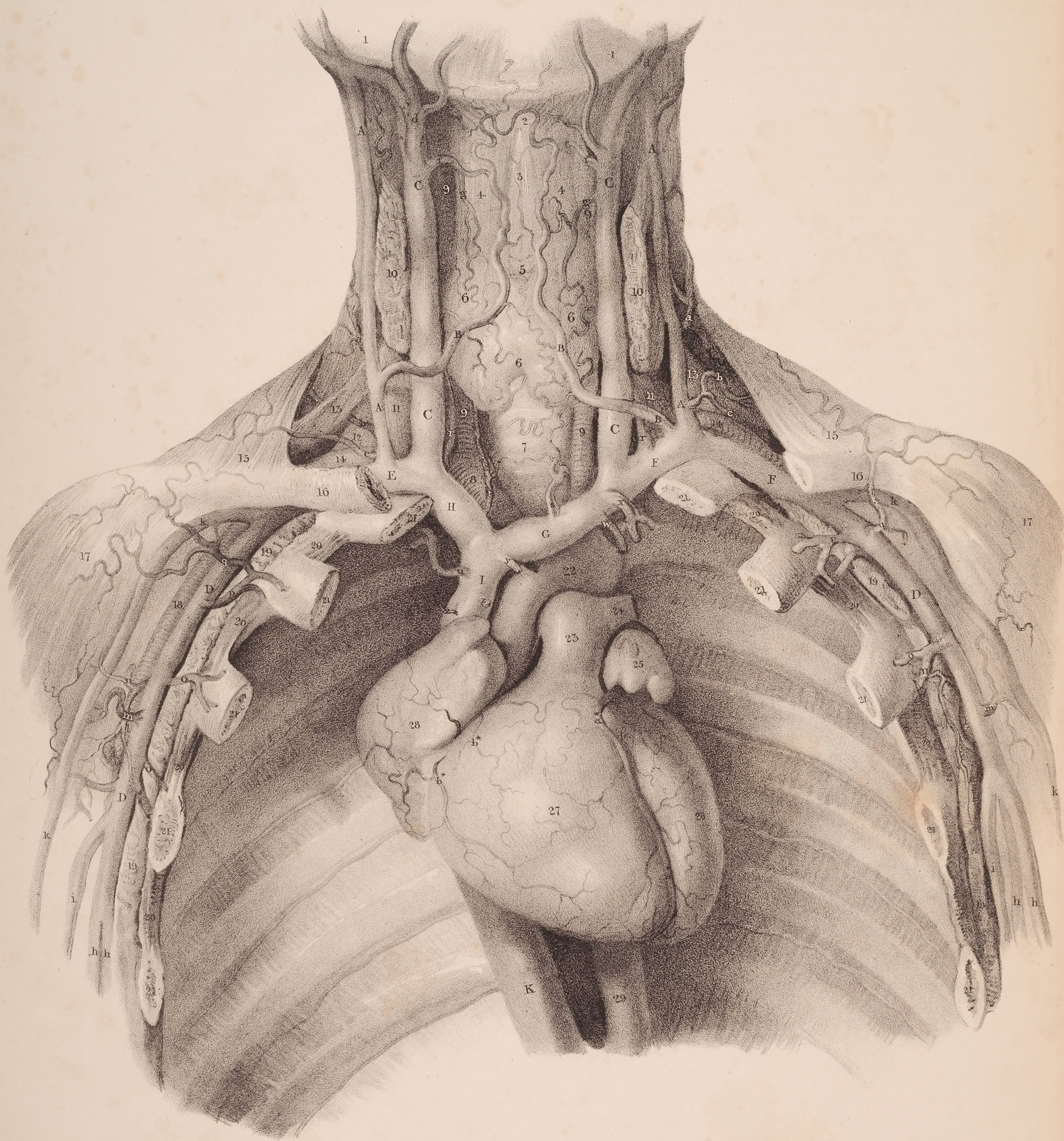
a, a. The venous arch on the back of the hand, formed by branches from the fingers and thumb ; it pours its blood on the one side into the radial, on the other into the ulnar vein. b, b. A large posterior venous trunk, which collects the blood from the back part of the fore-arm, and unites near the middle of its course with the radial cutaneous vein. c, c. The radical vein of the posterior ulnar cutaneous (*v. salvatella*). d. A large communicating branch between the radial and posterior ulnar cutaneous veins. e. A communicating branch which unites with the anterior ulnar cutaneous vein. f. A considerable vein formed by the reunion of the small veins around the elbow, which opens into the same vein near its termination.

Fig. 1

Fig. 2.



Plate 57.



W. J. E. Wilson inv.

J. Walsh del.

W. Fairland sculp.

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the vessel which extends from the skull to this point corresponds with the internal carotid artery, and receives its residual blood, it may with much propriety (and also with advantage, as tending to render the nomenclature uniform) be called *vena carotis interna*. Some confusion would arise from calling it "cephalica," as the external superficial vein of the arm has, without any proper reason, received that name. Again, the short vessel which extends downwards from the junction of the facial and temporal veins and joins the preceding, may, for the like reason, be called *vena carotis externa*; and finally, the trunk which results from the conflux of these vessels, and which extends thence down to the inner end of the clavicle, should be called *vena carotis communis*. At present, the entire length of the vessel included between the point just named and the base of the skull, is known as the internal "jugular" vein, as if it belonged to the throat, and had no correspondence in its divisions and distribution with the artery which it accompanies. However, we must defer to usage, and continue for the present so to name it.

The internal jugular vein having passed down to a level with the os hyoides, receives the common trunk formed by the facial and temporal veins, and then becomes considerably enlarged. It descends parallel with the common carotid artery, lying at its outside enclosed in the same sheath, together with the vagus nerve, and at the root of the neck joins nearly at a right angle with the subclavian vein, and so forms the innominata, or brachio-cephalic. Previously to its junction with the facial vein, the internal jugular receives branches from the tongue, pharynx, and occiput:—*Vena lingualis* (plate XXXV. g*) commences at the side and upper surface of the tongue, passes backwards, receiving branches from the sublingual gland; occasionally the ranine vein joins it, sometimes also the pharyngeal. In either case it passes backwards between the mylo-hyoideus and hyo-glossus muscles, to open into the jugular vein. *Vena pharyngea* (f*) commences at the back and sides of the pharynx, and terminates in the lingual, or separately in the jugular vein. *Vena occipitalis* (h*, h*)

PLATE XXXVII.

This plate represents the great venous trunks which unite to form the superior vena cava. The internal jugular veins are brought into view by removing the sterno-hyoid, sterno-thyroid, and the lower portion of the sterno-mastoid muscles. The heart, with the great vessels arising from its base, are exposed by sawing through the clavicles and ribs, and removing the sternum, with the whole anterior wall of the thorax.

Nos. 1, 1. The lower border of the inferior maxilla. 2. The body of the hyoid bone. 3. The thyroid cartilage. 4, 4. The thyro-hyoid muscles. 5. The cricoid cartilage. 6, 6. The thyroid gland. 7. The trachea. 8. The brachio-cephalic artery. 9, 9. The carotid arteries. 10, 10. The cut surface of the sterno-mastoid muscle at each side. 11, 11. The anterior scalenus muscle at each side. 12. The posterior scalenus at the right side. 13, 13. The inferior portion of the omo-hyoid muscle. 14, 14. The subclavian arteries. 15, 15. The trapezius muscle at each side. 16, 16. The divided clavicles. 17, 17. The deltoid muscles. 18. The axillary artery of the right upper extremity. 19, 19. The serratus magnus divided by an incision parallel to the cut extremities of the ribs. 20, 20. The intercostal muscles at each side, divided by the vertical section. 21, 21. The cut extremities of the ribs. 22. The arch of the aorta. 23. The trunk of the pulmonary artery. 24. The left pulmonary artery. 25. The left auricle of the heart. 26. The left ventricle. 27. The right ventricle. 28. The right auricle. 29. The descending aorta.

A, A. The external jugular vein (v. jugularis externa) at each side.

a, a. The posterior superficial vein of the neck. b, b. The posterior scapular veins. c, c. The supra-scapular veins.

B, B. The anterior jugular veins (v. jugulares anteriores), formed by superficial branches from the fore-part of the neck and thyroid gland. The vein of the right side opens into the external jugular, that of the left into the subclavian vein. C, C. The internal jugular veins (v. jugulares internæ).

d, d. The common trunk formed by the facial and temporal veins. e, e. The lingual veins. f, f. The superior thyroid veins. g, g. The middle thyroid veins.

D, D. The axillary veins (v. axillares).

h, h. The venæ comites of the brachial vein. i, i. The basilic veins at each side. k, k. The cephalic veins.

l, l. The trunk formed by the subscapular and posterior circumflex veins at each side. m, m. The anterior circumflex veins. n, n. The axillary thoracic veins. o, o. The inferior thoracic veins. p, p. The superior thoracic veins. q, q. The acromial thoracic veins.

E. The right subclavian vein (v. subclavia dextra). F, F. The left subclavian vein (v. subclavia sinistra).

r, r. The vertebral veins (v. vertebrales).

G. The left brachio-cephalic vein (v. brachio-cephalica sinistra, innominata). H. The right brachio-cephalic vein (v. brachio-cephalica dextra, innominata).

s. The left inferior thyroid vein (v. thyroidea inferior). t. The right inferior thyroid vein. u. The internal mammary vein of the right side (v. mammaria interna). w. The left internal mammary vein. x. The superior intercostal vein (v. intercostalis superior). y. A small pericardiac vein. z, z. Small branches from the mediastinum and pericardium. a*. The large cardiac vein (v. cordis maxima). b*, b*. Small cardiac veins (v. cordis parvæ).

corresponds in its course, and in the distribution of its branches, with the artery of the same name. It communicates with a plexus of veins on the outside of the occiput, and terminates occasionally in the external jugular vein, but more frequently in the internal.

Vena laryngea (i*) is a small vessel whose branches come out of the larynx through the thyrohyoid membrane; they unite and form one vein, which opens into the internal jugular (its anterior or facial division): sometimes it terminates in the superior thyroid vein.

Vena thyroidea superior (k*) arises by ramusculi, which ramify in the thyroid gland, in company with the branches of the superior thyroid artery. These unite and form a single vessel, which runs transversely outwards, and open into the jugular vein (its common trunk). Lower down we find another branch coming from the same source (*vena thyroidea media*; l*).

VEINS OF THE UPPER EXTREMITIES.

The veins of the upper extremity are divisible into two sets, one being superficial, the other deep-seated. The superficial veins are much larger, and lie between the skin and fascia. They commence on the dorsal surface of the fingers, and as they converge and communicate with one another on the back of the hand, they form a sort of venous plexus, from which issue two chief veins, that take, one the radial, the other the ulnar border of the fore-arm.

The Radial Cutaneous vein (plate XXXVI. A, A; *vena radialis cutanea*, v. *cephalica*) commences by ramusculi placed on the dorsal surface of the thumb and fore-finger. These ascend upon the outer border of the wrist, and form by their union a pretty large vessel, which passes along the radial border of the fore-arm, receiving numerous branches from its anterior and posterior surfaces. At the bend of the arm it receives a division of the median vein, and then continues its course at the outer side of the upper arm, and is named the *cephalic* vein. The cephalic vein (v. *cephalica*, fig. 1, B, B) thus formed ascends along the external border of the biceps muscle, and then in the interval between the pectoralis major and deltoid, and finally terminates in the axillary vein, between the coracoid process and the clavicle.

There are two ulnar cutaneous veins (plate XXXVI. fig. 1, C, D, fig. 2, B; *vena ulnaris cutanea*, *anterior et posterior*), one on the anterior, the other on the posterior surface of the fore-arm. The posterior one begins on the back of the hand by some ramusculi, which unite to form a vein placed over the fourth metacarpal space, and called by some of the older anatomists "salvatella" (fig. 2, c, c). This proceeds along the ulnar border of the fore-arm, at its posterior aspect, and somewhat below the bend of the elbow, turns forwards to join with the anterior ulnar cutaneous vein. The vein last named commences upon the anterior surface of the wrist, and thence ascends along the fore-arm, communicating by branches with the median vein on the one hand, and the posterior ulnar cutaneous on the other. At the bend of the elbow it unites with the posterior ulnar cutaneous vein, and assumes the name of "basilic vein."

The Basilic vein (plate XXXVI. fig. 1, E, E; v. *basilica*) is usually of considerable size; it receives at its origin a division of the median vein (median basilic), and ascending along the inner border of the biceps muscle, in front of the brachial artery, terminates in one of the *venæ comites* of that vessel, or in the axillary vein. The position and relations of the veins here described are sufficiently expressed by calling them radial and ulnar cutaneous whilst in the fore-arm, and internal and external brachial in the upper arm. The terms "basilic" and "cephalic" serve no useful purpose.

The Median vein (plate XXXVI. fig. 1, F; v. *mediana*).—The median vein results from the union, on the anterior part of the fore-arm, of several branches. It is a short trunk, which serves as a means of communication between the ulnar and radial veins on each side, as well as between the superficial and deep veins of the arm. Its length is subject to many varieties; it terminates by dividing into two branches, which diverge at an angle; one inclining inwards to join the basilic vein, and thence named *median-basilic* (G), passes in front of the brachial artery, from which it is separated by the fibrous offset given by the tendon of the biceps muscle to the fascia covering the flexor muscles; it is crossed by twigs of the internal cutaneous nerve: the other division (*median-cephalic*, H) directed outwards, unites with the cephalic vein; this is crossed by branches of the external cutaneous nerve. The termination of the median vein is also connected with the deep veins by a short branch (g), which sinks between the muscles, to the veins accompanying the brachial artery. The nomenclature may be simplified by considering these three as communicating branches, and so naming them internal, external, and middle.

Of the deep-seated veins.—The brachial artery, its branches, and their several divisions, are each accompanied by two veins, hence named *venæ comites*.

The deep Ulnar veins (plate XXXVI. fig. 1. k, k; *venæ comites arteriæ ulnaris*).—On the palmar surface of the hand the incipient ramusculi disposed along the borders of the digital phalanges become united at the cleft between the fingers into one small vessel, which, with one similarly formed from the contiguous border of the next finger, run along the inter-osseous spaces, and terminate in the superficial palmar arch of veins, from which two branches proceed at each side of the wrist, the external following the course of the superficialis volæ artery, whilst those on the inner side accompany the ulnar artery. The deep ulnar veins, commencing thus at the inner side of the superficial palmar arch, pass in front of the wrist, where they communicate with the inter-osseous and the superficial veins; then proceeding upwards along the inner side of the fore-arm, in apposition with the ulnar artery, they receive several branches from the neighbouring muscles; and lastly, being joined by the vessels which accompany the inter-osseous and ulnar recurrent arteries, unite with the deep radial veins to form the *venæ comites* of the brachial artery.

The Inter-osseous veins (v. com. art. inter-oss.) consist of two sets (anterior and posterior), corresponding to the arteries with which they are associated. The anterior take their rise in front of the wrist-joint, where they communicate freely with the deep radial and ulnar veins. In their course upwards they are joined by several small branches, and are connected at the lower part of the fore-arm with veins situated posteriorly, by means of branches which pass through the inter-osseous membrane near the elbow-joint; after being joined by the posterior inter-osseous veins, they open into the *venæ comites* of the ulnar artery. The veins which accompany the posterior inter-osseous artery, previously to passing from behind to join with the anterior, communicate by their incipient radicles with the ulnar cutaneous veins, and through branches accompanying the recurrent inter-osseous artery, with the cephalic vein.

The small radicles which give rise to the deep radial veins (*venæ comites art. radialis*; plate XXXVI. fig. 1. l, l) run upon the inter-osseous muscles of the hand; they are united in front with the digital veins previously described, and at each end of the space separating the metacarpal bones, are connected by perforating branches with small vessels situated on the back of the hand; by uniting across the carpal end of the metacarpus, they form an arch corresponding with that formed by the radial artery. This deep venous arch communicates on its inner side with the superficial palmar arch, and from its radial side proceed what may be considered properly the *venæ comites* of the radial artery. These vessels, when passing upwards to the fore-arm, receive at the wrist a dorsal branch, and one which passes over the small muscles of the thumb, with the superficialis volæ artery; then pursuing the course of the radial artery, they are joined by small veins from the surrounding parts, and end in the *venæ comites* of the upper arm.

The accompanying veins of the brachial artery (*venæ comites arteriæ brachialis*; plate XXXVI. fig. 1, m, m), resulting from the union of the deep ulnar and radial veins just described, follow, like the several vessels of the same class, the course of the artery with which they are associated. They are joined in their progress, from the bend of the elbow upwards on the arm, by the veins which are distributed with the branches of the brachial artery, namely, the anastomotic and the two deep or collateral arteries of the arm. At the lower margin of the axillary muscles, the brachial veins unite to form the axillary; not unfrequently, however, one of them will be found to come forward and unite with the basilic, which soon becomes continuous with the axillary vein.

Between the several veins of the upper extremity hitherto described, numerous connexions exist in their whole course. Thus, those placed immediately under the integument are connected by branches arching in different directions from one to the other over the hand and fore-arm; each pair of *venæ comites* are united by short transverse vessels crossing the artery which they accompany, whilst between those attending the different arteries frequent communications exist; moreover, as has been in many instances specially indicated, the different series of vessels, namely, those situated superficially and more deeply, communicate freely, especially in the neighbourhood of joints. This disposition prevents the occurrence of any impediment to the course of the circulation, by reason of muscular action, or the frequent and varied motions of the joints.

The Axillary vein (plate XXXVI. fig. 1, I; plate XXXVII. D, D: v. axillaris) arches, like the corresponding artery, from the margin of the axillary muscles to the lower border of the first rib; it is covered by the pectoral muscles and the costo-coracoid membrane, and is placed anterior to the axillary artery. The branches which open into the axillary vein are very numerous. It results, as above stated, from the union of the *venæ comites* of the brachial artery; it receives the

veins of the arm (the basilic at its commencement, the cephalic towards its termination); it is also joined by the several veins corresponding with the branches of the axillary artery, viz. the two circumflex (l, m) and the subscapular (l) from the shoulder, the alar (n) from the axilla, and the inferior (o), the superior (p), and acromial (q) thoracic veins from the side of the chest. The axillary vein, therefore, returns all the blood from the superior extremity; its size is very considerable.

The Subclavian veins (plate XXXVII. E, F; v. subclaviæ, dextra et sinistra) are the continuation of the axillary. Each extends from the lower margin of the first rib to the inner end of the clavicle, behind which it is joined by the internal jugular vein, the union forming the vena innominata, or brachio-cephalica. The subclavian vein arches over the first rib; it is covered by the clavicle, the subclavius, and the sterno-mastoid muscles, and lies on a plane anterior to the corresponding artery, from which, while resting on the rib, it is separated by the scalenus anticus muscle and the phrenic nerve. On the outer side of the last-named muscle it receives the external jugular vein, and on its inner side becomes united with the internal jugular: in their course to join it, both these veins pass in front of the subclavian artery, and add to the difficulty of placing a ligature on that vessel. The subclavian vein also receives the following as so many branches:—

The Vertebral vein (plate XXXVII. r, r; v. vertebralis) takes its rise from several ramusculi proceeding from the pericranium and the deep muscles lying behind the foramen magnum of the occipital bone; having passed from thence outwards and downwards to reach the foramen in the transverse process of the atlas, it comes into relation with the vertebral artery, with which it descends through the canal formed by the corresponding foramina of the other cervical vertebræ as far as the sixth. Here it emerges and joins the subclavian vein; a small branch or division sometimes passes through the foramen in the seventh vertebra, and opens separately into the same vein. It is joined in its course by several branches proceeding from the neighbouring muscles, also immediately before its termination by a vein corresponding to the ramus profundus of the subclavian artery, and in the same situation by another of considerable size, which runs longitudinally on the vertebræ. It communicates frequently with the vein last indicated, and through it with the lateral sinus, by means of an emissary vein passing through the foramen in the mastoid portion of the temporal bone; a connexion is established between the vertebral vein and the occipital sinus through the condyloid foramen, and through the intervertebral foramina it maintains free communication with the following:—

The superior Intercostal vein (plate XXXVII. x, plate XLII.; vena intercostalis superior).—It sometimes happens that at the right side the veins corresponding with the superior intercostal artery pass downwards separately, to open into the vena azygos, as that vessel arches forwards to join the superior vena cava. When they unite to form a single vein, its size is much inferior to that on the left side. The left superior intercostal vein varies in length in different individuals, being small when the vena

PLATE XXXVIII.

The spinal veins are here shown.

Fig. 1. The dorsi-spinal veins (v. dorsi-spinales). This view is obtained by removing all the muscles of the back, together with the soft parts of the head and neck, the ribs, and iliac bones.

No. 1. The tubercle of the occipital bone. 2, 2. The mastoid processes. 3, 3. The mastoid foramen at each side, through which passes a vein to communicate with the lateral sinus. 4. The spinous tubercle of the atlas. 5, 5. Its transverse processes. 6. The spinous process of the axis. 7, 7. The bifid spinous processes of the cervical vertebræ. 8. The spinous process of the last cervical vertebra. 9, 9. The first dorsal vertebra. 10, 10. The last dorsal. 11, 11. The first lumbar vertebra. 12, 12. The sacrum. 13, 13. The posterior sacral foramina. 14, 14. The articulating surfaces of the sacrum. 15. The coccyx.

a, a. Venous branches ramifying upon the inferior surface of the occiput; communicating below with the cervical dorsi-spinal veins. b, b. The mastoid vein at each side. c, c. Lateral branches of the cervical dorsi-spinal veins, communicating with the vertebral veins. d, d. The small vein which passes through the foramen in the transverse process of the last cervical vertebra. e, e. Venous branches from the surrounding muscles, which supply the dorsi-spinal veins.

Fig. 2. The spinal veins beneath the vertebral arches, which receive the blood from the dorsi-spinal. To obtain this view, the posterior part of the occipital bone, and the arches of all the vertebræ, and sacrum, are removed.

Nos. 1, 1. The dura mater, covering the lobes of the cerebellum. 2, 2. The dura mater of the spinal cord.

a, a. Veins ramifying upon the exterior of the dura mater. b, b. Veins in the cervical region, so numerous as almost to conceal the dura mater. c, c. Veins passing out from the spinal canal through the intervertebral foramina, and pouring their blood into the vertebral and deep cervical veins. d, d. Communicating veins opening into the superior intercostal vein. e, e. Communicating veins to the vena azygos minor. f, f. Communicating veins to the vena azygos major. g, g. Communicating branches to the lumbar veins.

Fig. 1.

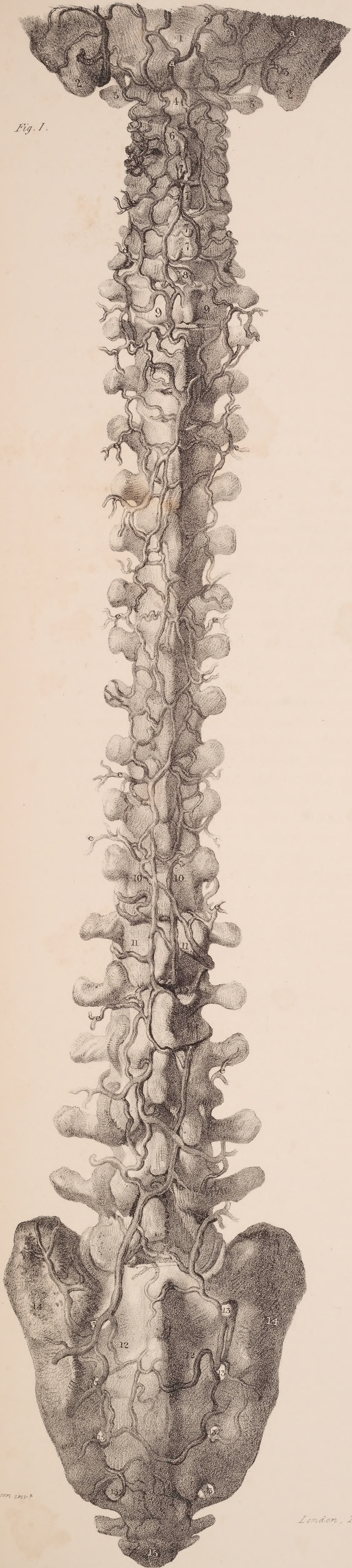


Fig. 2.

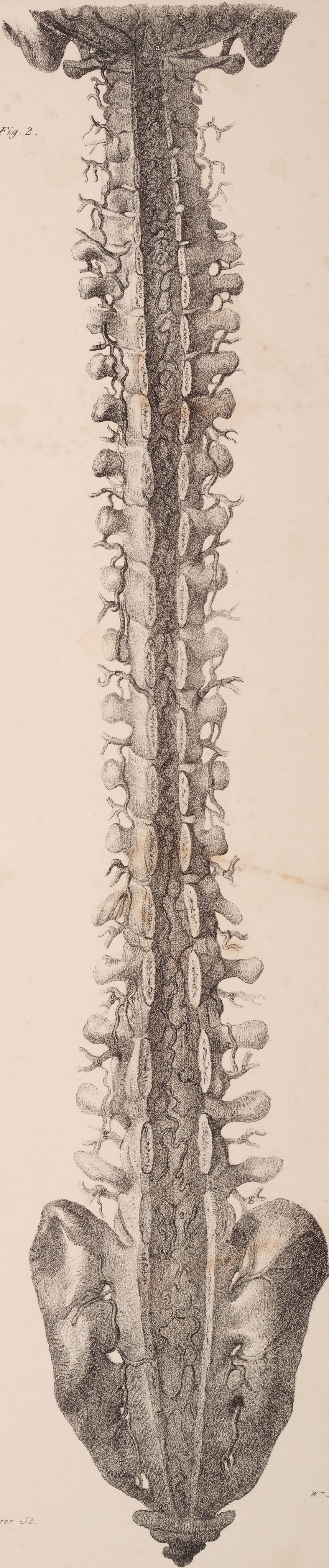


Fig. 2.



Fig. 7.

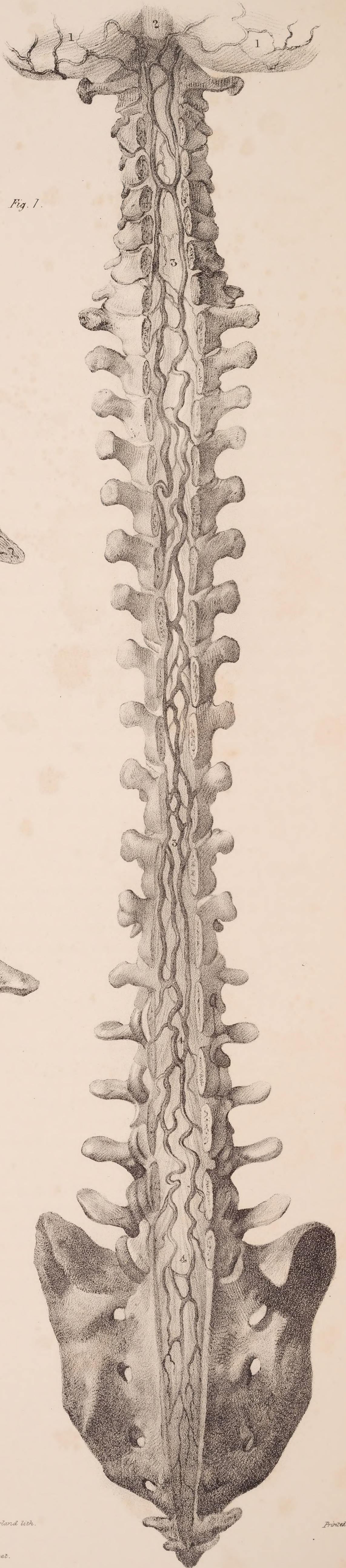


Fig. 3.

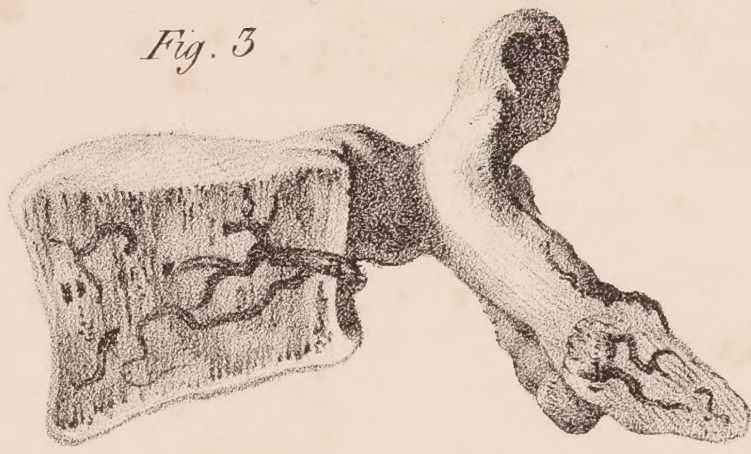
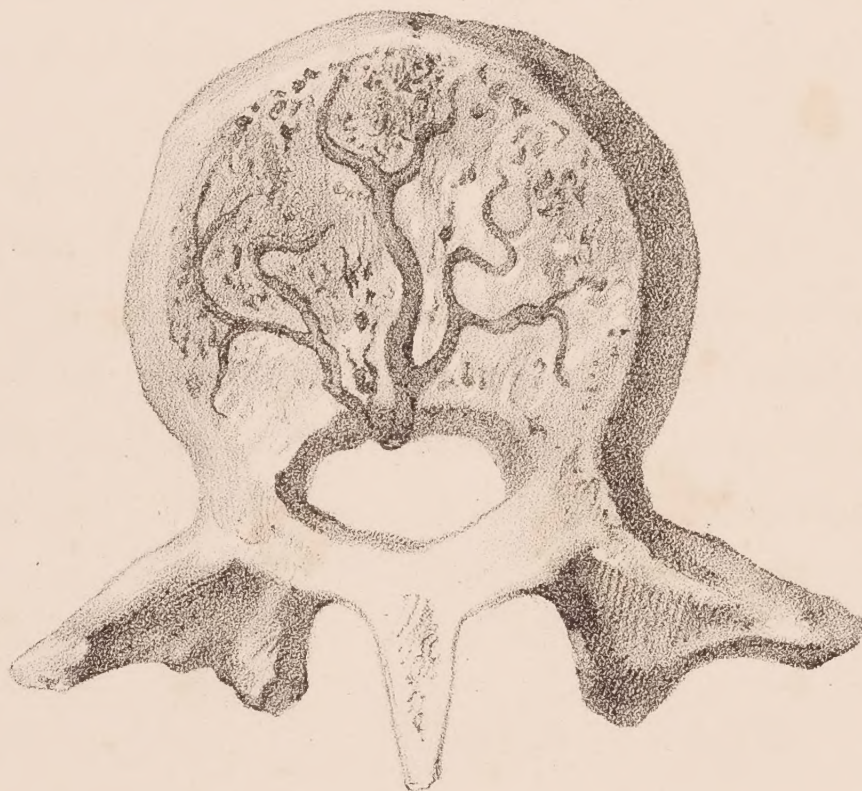


Fig. 4.



azygos minor is large, and *vice versâ*; usually the fifth intercostal branch turns upwards, and joins with or receives the fourth, third, second, and first, as it passes by the heads of the ribs. At the second vertebra it inclines forwards, and opens into the left brachio-cephalic vein. It receives in its course the left bronchial vein. The sixth intercostal vein generally crosses the spine, and opens separately into the azygos major; it communicates by a small branch with the azygos minor, and also with the left superior intercostal vein.

The Brachio-cephalic vein (vena innominata).—The blood returned from the superior extremities through the subclavian veins, and from the head and neck by the jugular veins, is poured into two trunks, which may therefore be named brachio-cephalic. These vessels (*venæ innominatæ*, v. *brachio-cephalicæ*; plate XXXVII. G, H), resulting from the union of the subclavian with the internal jugular vein at each side, extend from the inner extremities of both clavicles to beneath the cartilage of the first rib on the right side, where, by uniting, they form the superior vena cava. In consequence of the situation of the point at which they meet, the brachio-cephalic veins differ considerably in direction, length, and relations; that of the right side is very short and nearly vertical in its direction. The vein of the left side, about three times longer than the preceding, is directed transversely to the right, at the same time inclining downwards: it crosses behind the first bone of the sternum, separated from it by the sterno-hyoid and sterno-thyroid muscles, and by the thymus, when it exists, or some cellular tissue; it lies in front of the three primary branches given off from the transverse portion of the arch of the aorta.

The inferior Thyroid veins (plate XXXVII. s, t; *venæ thyroideæ inferiores*) emerge from a sort of venous plexus on the thyroid body—those of opposite sides communicate by small branches across the trachea. The vein of the left side descends in front of the trachea, behind the sterno-thyroid muscles, and ends in the left brachio-cephalic or innominata vein; that of the right side inclines outwards in some degree, and opens into the corresponding brachio-cephalic vein, or into the angle of union between it and the vessel of the opposite side.

The internal Mammary veins (plate XXXVII. u, w; *venæ mammariæ internæ*) follow exactly the course of the arteries of the same name. They arise by small branches, derived from the fore part of the walls of the abdomen, where they anastomose with the epigastric veins; from thence proceeding upwards behind the cartilages of the ribs between them and the pleura, they receive the veins which correspond with the anterior intercostal branches of the internal mammary artery (*v. intercostales anteriores*), together with some small diaphragmatic, thymic, and mediastinal ramusculi, and finally terminate—that of the left side in the left brachio-cephalic vein, that of the right side usually in the vena cava.

The superior Vena Cava (plate XXXVII. I; vena cava superior) conveys to the heart the blood which is returned from the head, the neck, the upper extremities, and the thorax. It extends in nearly a vertical direction from opposite the cartilage of the first rib on the right side of the sternum to the base of the heart, where it opens into the right auricle: at about an inch and a half above its termination, it is invested by the fibrous layer of the pericardium, the serous membrane being reflected over it. The superior cava lies immediately in front of the right pulmonary vessels, and between

PLATE XXXIX.

The veins enclosed within the vertebral canal.

Fig. 1. The medullary-spinal veins (*v. medullary-spinales*). These veins are displayed by removing the dura mater.

Nos. 1, 1. The lobes of the cerebellum. 2. The superior vermiform process. 3, 3. The spinal cord. 4, 4. The cauda equina.

Fig. 2. The great spinal veins (*veines meningo-rachidiennes*, Chaussier, Breschet.) To obtain a view of these veins, the arches of the vertebræ are cut deeper than in the former sections, and the spinal cord removed; they are then seen resting upon the posterior surface of the bodies of the vertebræ.

Nos. 1, 1. The line of intervertebral substance apparent between some of the bodies of the vertebræ.

a, a. The two great lateral venous trunks. b, b. The points at which the spinal veins receive the blood from the bodies of the vertebræ.

Fig. 3. A lateral section of a lumbar vertebra, to show the proper vertebral vein (*v. basis vertebræ*).

a. The venous trunk escaping through the foramen in the middle of the body of the vertebra. b. Some small venous branches observed in the cancellous structure of the spinous process.

Fig. 4. A transverse section of a lumbar vertebra, showing the ramifications of the same vein.

the right lung and the aorta, which partly overlap it. It receives several small veins from the pericardium and the mediastinum, and lastly is joined from behind by the vena azygos.

The Azygos vein (plate XLII. G ; vena azygos, v. sine pari).—The name given to this vein signifies that it has no fellow or corresponding vessel (α priv. ζευγευμαι) ; but it cannot be applied with propriety, inasmuch as there is a similar vessel on the opposite side, though of smaller size (azygos minor). The incipient radicles of the vena azygos issue either from the inferior cava, where that vessel turns forward to reach the opening in the diaphragm, or much more frequently from one of the lumbar veins of the right side, sometimes from the renal vein. The vein passes from the abdomen into the thorax, through the aortic opening in the diaphragm, or more externally through the fibres of that muscle, and ascends on the bodies of the dorsal vertebræ, until it arrives opposite the root of the right lung : here it arches forward above the bronchus, and opens into the superior vena cava, immediately above the point at which that vessel is invested by the pericardium. When passing through the diaphragm, this vein is in company with the thoracic duct, and both are situated on the right side of the aorta : in the thorax, maintaining the same position with respect to the duct and the œsophagus, it crosses in front of the intercostal arteries, and is covered by the pleura. It receives the several veins which accompany the aortic intercostal arteries of the right side (*v. intercostales posteriores*), and, at about the seventh dorsal vertebra, the v. azygos minor : it is also joined by several œsophageal and other small veins, and near its termination by the bronchial vein of the right lung. It is connected with the commencement of the left superior intercostal vein ; and as it communicates with the inferior vena cava, while it terminates in the superior, it forms a connexion between both these vessels. Meckel in one instance found the azygos terminating in the subclavian vein.

The lesser Vena Azygos (plate XLII. H ; vena azygos minor) commences from one of the lumbar veins, or from the left renal vein, and having entered the thorax with the aorta, or through the crus of the diaphragm, runs on the spine, and opens into the preceding vein, opposite the sixth or seventh dorsal vertebra. It receives the lower intercostal veins of the left side.

The Bronchial veins (plate XLII. d ; venæ bronchiales) return the residue of the blood employed in the nutrition of the lungs. They commence in the minute texture of these organs by radicles corresponding with those of the bronchial arteries. Their course is determined by that of the bronchi, which in a manner support them, as they pass towards the back part of the lungs. That of the right side opens into the vena azygos major near its termination, that of the opposite side ends in the superior intercostal vein.

VEINS OF THE SPINE AND CRANIUM.

The part of the venous system contained within the skull and spinal canal, presents certain peculiarities deserving especial notice. In the skull we find a series of sinuses, representing at once reservoirs and canals, interposed between the small veins which directly receive the blood from the arteries, and the large trunks (jugular veins) which transmit it towards the heart. The sinuses in the skull are formed within the layers of the dura mater, their cavities being lined by a continuation of the inner coat or membrane of the veins : they are very numerous, and vary considerably in form and size. In the spinal canal a chain of venous tubes runs along its whole length, which present some analogy to the cranial sinuses, but still differ in such a way that we may consider them as a transition-link between the veins diffused throughout the body and the sinuses.

The veins within and upon the spinal column may be arranged under the following heads :—viz. 1. Those placed deeply in the vertebral grooves, having close relation to the spines and arches of the vertebræ ; 2. The veins of the spinal cord itself ; 3. Two long veins, or rather chains of veins, extending the whole length of the canal ; 4. Veins lodged within the bodies of the vertebræ ; 5. Branches of communication which connect all these together ; and, finally, another set, by which they are brought into connexion with the general venous system.

Preparation and Dissection.—The long spinal veins were first described by Chaussier ; the veins of the cranial and spinal bones, as well as of the osseous system generally, were subsequently examined with great care by Dupuytren, and demonstrated in his lectures on anatomy. Breschet subsequently took up the subject,* and still continues his researches upon it.† In order to inject these vessels, an old and emaciated subject should be chosen, as the venous system becomes more developed in advanced age ; it should be placed in a warm-bath in the usual way, and thoroughly warmed previous

* Essai sur les Veines du Rachis. 4to.

† Traité Anatomique sur le Système Veineux. Fol. avec planches.

to injection. As the vessels cannot be filled from any single vessel, advantage must be taken of their numerous connexions to inject them from different points. With this view, an injecting pipe must be inserted into the superior longitudinal sinus, another into the vena azygos major, also into the superior and inferior cava. Through all these vessels the injecting fluid should be conveyed, and through at least two or three of them, if possible, at the same time. The posterior and external veins (if the injection has succeeded) are to be traced through the mass of dorsal muscles; those within the spine are best seen by making a vertical section of it and of the skull, dividing it into two lateral halves; or the arches may be cut out, and the cavity exposed.

The Dorsi-spinal veins (plate XXXVIII. fig. 1; venæ dorsi-spinales; Dupuytren, Breschet).—The blood is received and returned from the muscles and tegument placed along the back part of the spine, by a series of short veins, which run horizontally forwards and terminate in some of the larger veins within the spine; hence they are named as above. Commencing by small ramusculi, they gradually increase as they run forwards, close by the spinous processes; and on reaching the interval between the arches of the vertebræ, they pierce the ligamenta subflava, to terminate in a venous plexus within the canal. Towards the external part of the intervertebral grooves another set of veins arise, which pass obliquely inwards, through the inter-transverse spaces, in company with the posterior branches of the lumbar and intercostal arteries, and open into the veins which accompany these vessels.

The Medulli-spinal veins (plate XXXIX. fig. 1; v. medulli-spinales; Breschet).—These appertain solely to the spinal cord and its nerves, upon which they are placed, enclosed within the tube of the dura mater. Though they communicate by branches with the other spinal veins, they are not injected concurrently with them, even when the injecting process above described is most successful. Breschet gives the following as the best method of demonstrating them:—

Preparation.—Let the injection consist of a strong solution of isinglass, coloured with indigo or Prussian blue, open the spinal canal in the lumbar region, slit up the dura mater, and search for one of the largest of the veins which rest upon the cord; into this pass the point of a very small syringe—a silver injecting pipe would answer better; then cautiously introduce the injection, for the coats of the veins are exceedingly thin and weak.

The medulli-spinal veins are very small, long, and tortuous; they run upon both surfaces of the cord, where they form a diffused plexus or net-work, by mutually giving and receiving branches. The general direction of these vessels is from below upwards, but still they do not increase as they approach the base of the skull, on the contrary their size is smaller than in the lumbar region. This arises from the fact, that the blood brought into these superficial vessels, by the small veins which open into them from the substance of the cord, is sent outwards directly by the branches which accompany the nerves towards the intervertebral foramina, where they pour it into the great spinal veins. Near the base of the skull the medulli-spinal veins unite, and form two or three small trunks, which maintain, by transverse branches, communications with the vertebral veins, after which they terminate in the inferior cerebellar veins, or in the petrosal sinuses.

The proper Vertebral veins (plate XXXIX. figs. 3 and 4; v. basis vertebræ).—The large apertures observable in the bodies of the vertebræ lodge veins of corresponding size: any arterial branches which may enter by them are very small. In the posterior flat surface of these bones, and equidistant from their upper and under margins, we find a large foramen leading into a canal, which, running forwards for two or three lines, divides into two similar tubes of smaller size. Each of the latter turns inwards and unites with its fellow, forming an arch, from the convexity of which small branches pass obliquely forwards. Some of these terminate in the cancelli of the bone, others are prolonged to its convex surface, where they anastomose with some of the superficial veins. Whilst the final ramifications of these venous canals terminate, as has been just stated, or rather (taking it in the course of the current) commence, the trunk of each when it reaches the spinal canal divides into two branches, which diverge and terminate in the large spinal veins.

The blood collected by the different vessels here described is poured by them into two large veins, or rather tortuous venous canals, which extend the whole length of the spine lodged in its interior. These vessels may be named the great spinal veins; Chaussier and Breschet call them *veines meningo-rachidiennes*; but they are not enclosed within, or formed by, the dura mater (μηνιγγίς), therefore the name is not well chosen. They do not present the appearance of continuous tubes; for, from space to space, they are alternately constricted and enlarged, so as to resemble a series of links, the constricted points corresponding with the intervertebral foramina, where they are drawn forwards, and in a manner secured by the branches of communication which pass outwards. They lie behind

the bodies of the vertebræ, occupying the interval at each side between the intervertebral foramina and those in the centre of the bodies of these bones. In some parts the links of the chain which they form are double, or even triple, and occasionally detached from any connexion with the link above or that below, which shows that each portion is, as it were, a separate trunk by itself, receiving the blood on the one hand, and propelling it into the general circulation on the other, and that the current therefore does not ascend or descend along the column which the series of veins forms. Each of these venous trunks is as long as the interval between two intervertebral foramina. In the thoracic region their communicating branches open into the intercostal veins, in the loins into the lumbar veins, in the neck for the most part into the vertebral.

A complex interlacement of tortuous veins (plate XXXVIII. fig. 2) is established along the inner surface of the arches of the vertebræ. In the lower part of the canal the interlacement is not so close as in the upper portion, where it usually conceals (if the injection has run minutely) the whole surface of the dura mater. These veins also converge to the intervertebral foramina, and open by rather narrow channels into the intercostal veins. From a consideration of the connexion and arrangement of the different parts of this complex apparatus, it would appear that the blood at each stage flows through them from behind forwards horizontally. The dorsi-spinal veins pour their blood into the plexus inside the arches of the vertebræ, from which it is collected by two or three small branches that converge to the intervertebral foramina, and open into some of the prævertebral

PLATE XL.

This plate exhibits the cerebral sinuses and veins.

Fig. 1. A vertical section of the head, displaying the cavity of the cranium lined by the dura mater, with the processes formed by the latter membrane; also the septum nasi.

Nos. 1, 1. Section of the frontal bone. 2, 2. Section of the parietal bone. 3. Cut surface of the occipital bone. 4. Foramen magnum. 5. Basilar process of the occipital bone. 6. The sphenoid cells. 7. The posterior clinoid process. 8. The processus olivaris of the sphenoid bone. 9. The cribriform lamella. 10. The crista galli. 11. The frontal sinuses. 12, 12. The falx major. 13. The tentorium cerebelli. 14. The petrous portion of the temporal bone, with the internal auditory foramen. 15. The lesser wing of the sphenoid. 16, 16. The interior of the cranium lined by the dura mater, through which are seen the branches of the arteria meningea media. 17, 17. The septum nasi. 18. Section of the palate processes of the superior maxillary and palate bones. 19. The right posterior naris. 20. The internal pterygoid plate of the sphenoid bone.

A, A. The superior longitudinal sinus (sinus longitudinalis). B. The conflux of the sinuses (torcular Herophili). C, C. The right lateral sinus (s. lateralis) winding to its termination at the foramen lacerum posterius.

a, a. Cerebral veins, opening into the superior longitudinal sinus at an acute angle, and opposite to the current of the blood in that vessel. b, b. Small veins which return the blood from the falx cerebri. c, c. The inferior longitudinal sinus (s. longitudinalis inferior). d, d. The venæ Galeni returning the blood from the lateral ventricles. e. The straight, or fourth sinus (s. rectus). f. The superior petrosal sinus (s. petrosus superior). g. The inferior petrosal sinus (s. petrosus inferior). h. The occipital sinus (s. occipitalis posterior). i. A nasal vein which opens into the superior longitudinal sinus. k, k. A plexus of veins ramifying in the mucous membrane covering the septum. l. The sphenopalatine vein. m. The naso-palatine vein, maintaining a communication between the veins of the nose and palate. n, n. Palatine veins.

Fig. 2. A vertical view of the superior longitudinal sinus, with the cerebral veins opening into it from behind forwards. This view is obtained by removing the calvarium and the dura mater, leaving only a small portion of the latter membrane attached on each side of the sinus.

Nos. 1, 1. The cut surface of the circumference of the skull. 2, 2. The hemispheres of the brain. 3, 3. The cut edges of the dura mater on each side of the superior longitudinal sinus.

A, A. The superior longitudinal sinus.

a, a. Cerebral veins, lying in the depressions between the convolutions of the hemispheres. b, b. The openings of small veins from the diploe of the cranial bones.

Fig. 3. A diagram representing the formation of the superior and inferior longitudinal sinuses between the layers of the dura mater.

Nos. 1, 1. A section of the upper part of the frontal bone. 2, 2. The dura mater lining the bone. 3, 3. The inner layers of the dura mater divided so as to enclose the triangular space (a). 4. Vertical section of the falx cerebri.

a. The form of the triangular canal of the superior longitudinal sinus. b. Circular canal in the lower border of the falx, the inferior longitudinal sinus.

Fig. 4. A small portion of the superior longitudinal sinus removed from the skull, and laid open to show—

a, a. The obliquity of the apertures by which, b, b, the cerebral veins open into the canal, and, c, c, chordæ Willisii, which stretch transversely across the sinus. The arrow denotes the course of the current of the blood in the sinus, in opposition to the current poured in by the veins.

Fig. 1.

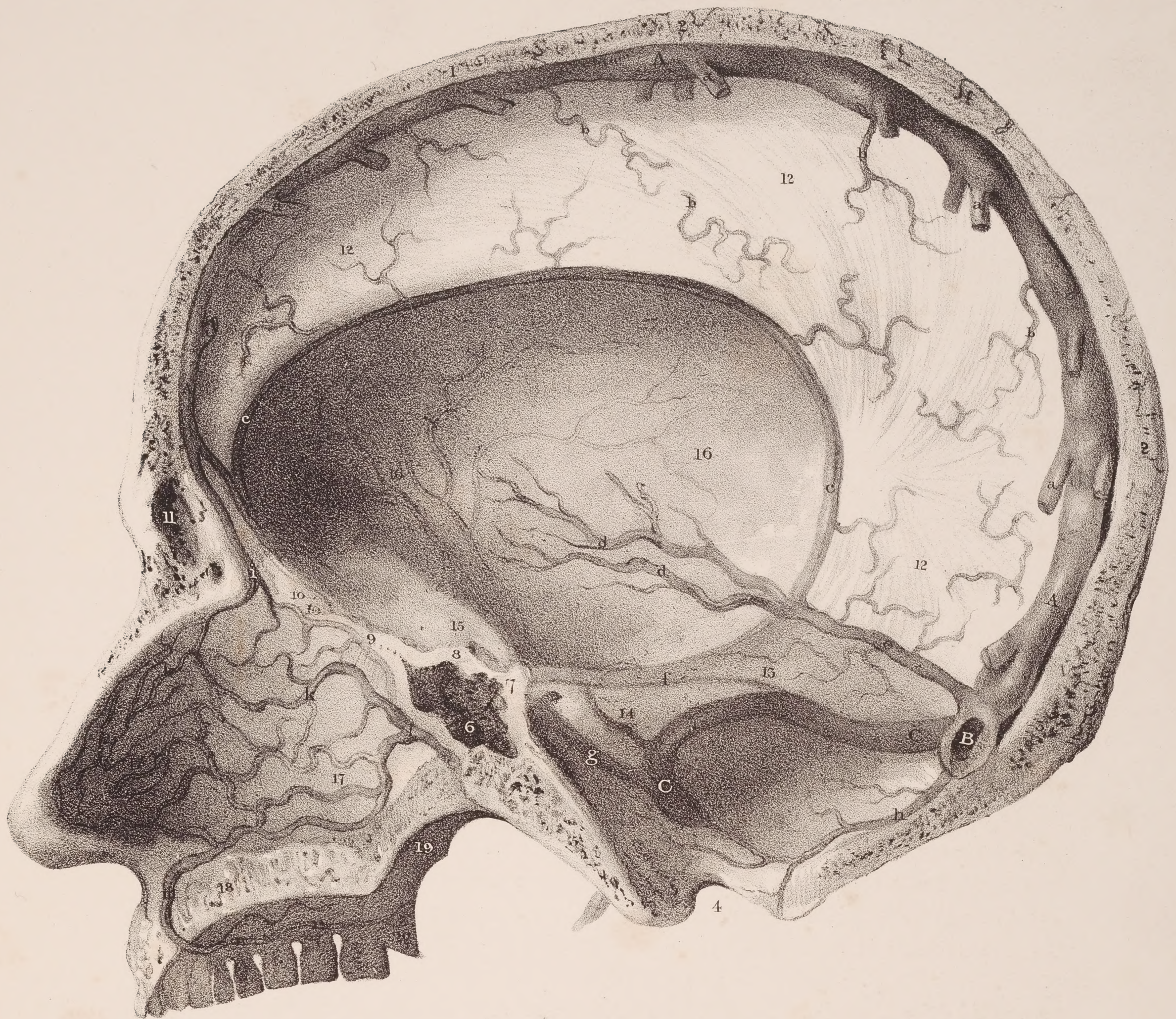


Fig. 2.



Fig. 3.



Fig. 4.

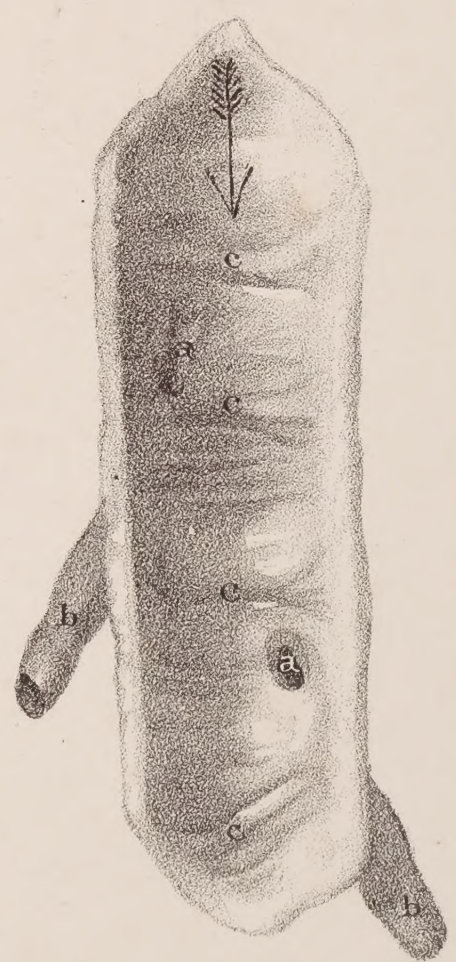


Plate 41.

Fig. 1.

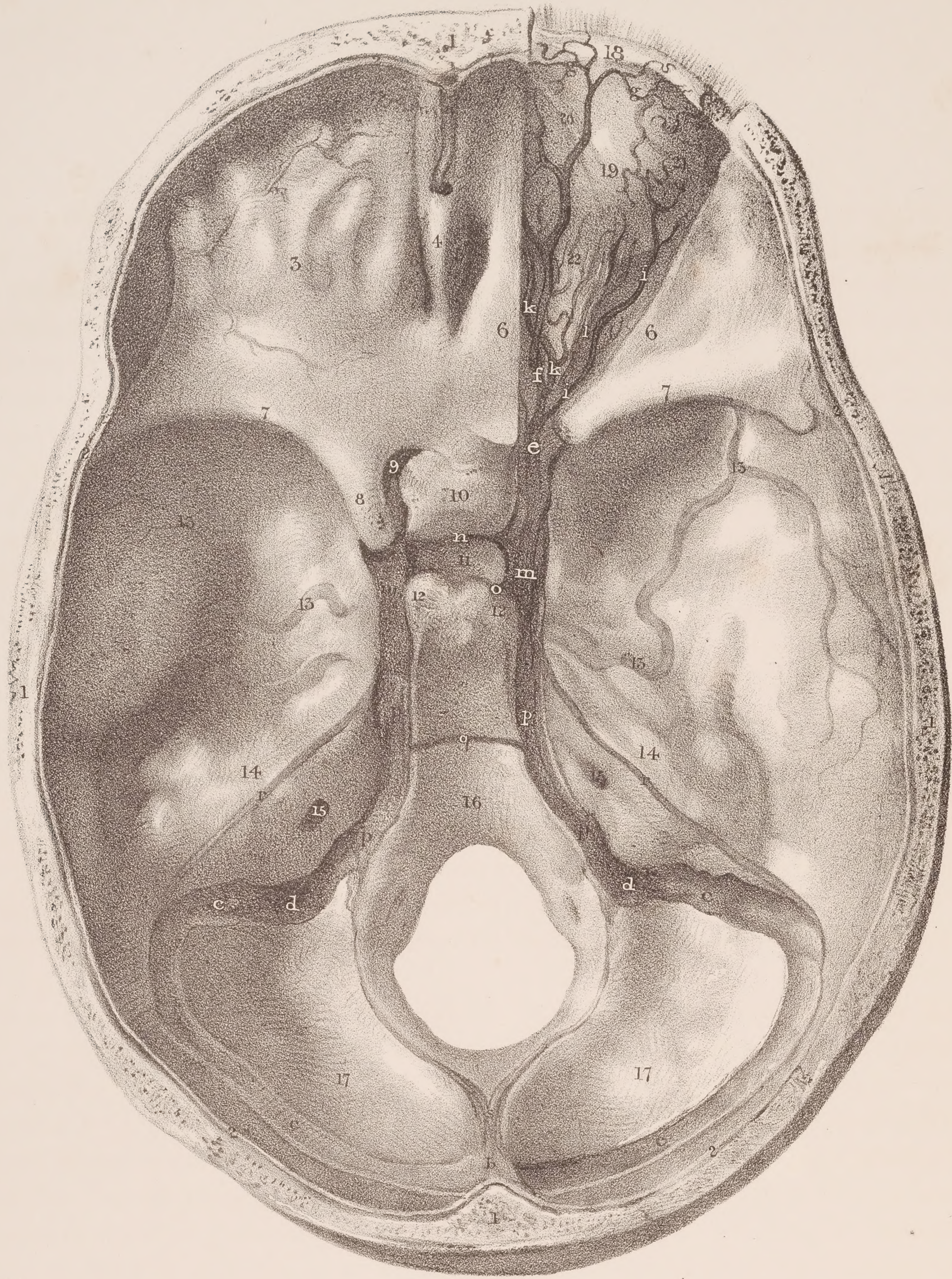


Fig. 2.



veins (lumbar, azygos, or cervical). Into these also the contents of the great spinal veins are conveyed by the short communicating branches already noticed.

This adjustment of the venous tubes necessarily determines the course of the current; but it will naturally be asked, what is the agency which propels it, seeing how many obstacles tend to retard its flow? The “vis à tergo” could not be sufficient of itself, where everything seems to favour stagnation. The chief, if not the sole propelling power, seems to be the physico-mechanical influence exerted by the expansion of the thorax; by means of which the pressure on the venous trunks within the chest is diminished, whilst that on all other parts remains undiminished, and so the current is made to flow towards that point where it meets the least resistance.

Cerebral veins (plate XL. fig. 2, a, a).—The part of the venous system contained within the skull consists of veins, properly so called, and sinuses, which resemble so many recipients or reservoirs. The veins which return the blood from the cerebral mass are divisible into two sets, one being superficial, the other deeply seated. The superficial veins of the brain branch out upon every part of its surface, their ultimate radicles dipping into its substance, whilst their large extremities terminate in the different sinuses. Upon the upper surface of the hemispheres the veins will be seen lodged in the sulci, between the convolutions, which give them a waving direction. They are not, however, confined to the sulci; for some of the branches will be observed to pass over the convexity of the convolutions. On reaching the margin of the great fissure between the hemispheres, (their general direction being for the most part transversely inwards,) they receive the branches which come up from the inner flat surface of the hemisphere, become invested by a tubular sheath of the arachnoid membrane, and turn forwards in such a way as to open obliquely into the superior longitudinal sinus.

The veins at the sides, and under the surface of the brain, are similarly placed; but their direction is outwards, to open into the lateral sinuses at each side.

The deep-seated or internal veins commence within the ventricles of the brain. Upon the surface of the corpus striatum several minute venous branches are seen, after having emerged from its interior. Most of these converge, and form a slender vein (*vena corporis striati*), which runs along the groove

PLATE XLI.

In this plate the sinuses of the base of the cranium and the veins of the diploë are shown.

Fig. 1. The upper hemisphere of the skull is removed, and the dura mater opened along the course of the venous sinuses, for the purpose of displaying their channels more distinctly. The veins of the orbit are brought into view on the right side by removing part of the orbital plate of the frontal bone, with a portion of the lesser wing of the sphenoid.

Nos. 1, 1. The cut surface of the circumference of the cranium. 2, 2. The cut edge of the dura mater. 3. The orbital plate of the frontal bone on the left side, covered by dura mater. 4. The crista galli process of the ethmoid bone, from which the anterior extremity of the falx cerebri is removed. 5, 5. The cribriform foramina for the transmission of the filaments of the olfactory nerves. 6, 6. The cut edge of the roof of the orbit. 7, 7. The lesser wing of the sphenoid. 8. The anterior clinoid process on the left side. 9. The optic foramen of the left side. 10. The olivary process of the sphenoid bone. 11. The sella Turcica. 12, 12. The posterior clinoid processes. 13, 13. Branches of the middle meningeal artery seen through the dura mater. 14, 14. Petrous portion of the temporal bone at each side. 15, 15. The internal auditory foramina. 16. The basilar process of the occipital bone. 17, 17. The inferior occipital fossæ, which lodge the lobes of the cerebellum. 18. The upper eyelid. 19. The globe of the eye. 20. The reflected tendon of the superior oblique muscle. 21. The lachrymal gland. 22. The optic nerve.

a. The commencement of the superior longitudinal sinus. b. The termination of the superior longitudinal sinus in the torcular Herophili. c, c. The lateral sinuses (s. laterales). d, d. The termination of the lateral sinuses at the jugular fossæ. e. The ophthalmic vein (v. ophthalmica), formed by the convergence of the orbital veins. f, f. The supra-orbital vein. g, g. Superior palpebral veins. h. The supra-trochlear vein. i, i. The lachrymal vein. k, k. The nasal vein. l, l. Ciliary veins. m, m. The cavernous sinus (s. cavernosus) at each side. n. The anterior semicircle of the circular sinus (s. circularis). o. Part of the posterior segment of the sinus; the rest is concealed by the posterior clinoid processes. p, p. The inferior petrosal sinuses (s. petrosi inferiores). q. The basilar sinus (s. occipitalis anterior;—basilaris). r, r. The superior petrosal sinuses (s. petrosi superiores). s. The occipital sinus (s. occipitalis posterior).

Fig. 2. represents the veins of the diploë. This view is obtained by removing the outer table of the skull; the venous canals are then exposed. They are extremely irregular in their distribution and dissimilar in different skulls.

a. A venous canal that terminated at the parietal foramen in the veins of the integument. b. Another canal which communicated with the mastoid foramen. This foramen was placed farther back than ordinary, in the occipital bone.

between the corpus striatum and optic thalamus, to open into one of the veins of the choroid plexus. The minute veins spread out in the choroid plexus pass backwards, and incline towards the middle line from each side, so as to form, by their union, two veins (*venæ Galeni*; plate XL. fig. 1, d, d). These, lying parallel, run directly backwards, enclosed within the velum interpositum, and escape from the ventricle by passing through the great fissure between the under surface of the corpus callosum and the tubercula quadrigemina. In this way they reach the anterior margin of the tentorium cerebelli, at its angle of union with the falx, where they terminate by opening into the straight sinus.

The veins of the cerebellum (*venæ cerebelli*) are disposed in two sets, not merely from a reference to their position, but also from a consideration of their direction and termination. Those of the upper surface incline inwards and forwards for the most part, and so will be found to run upon the superior vermiform process, over which they ascend a little to reach the straight sinus, in which they terminate: some, farther forward, open into the *venæ Galeni*. Those at the under surface run transversely outwards, and pour their contents into the lateral sinus.

Cerebral sinuses (plate XL. and plate XLI.)—The sinuses placed within the cranial cavity, and which are interposed between the veins above noticed and the internal jugular veins which receive the blood from them, are numerous; and, by reason of a difference in their position, admit of being divided into two sets, viz. those placed in the prominent folds of the dura mater, and those disposed at the base of the skull. The form and size of these reservoirs are various; but all are lined by a continuation of the inner membrane of the veins, the dura mater serving as a substitute for their fibrous coat, which extends no farther than the base of the skull.

The sinuses which are formed in the prominent processes of the dura mater converge to a common point, which corresponds with the internal occipital protuberance, and is called the *conflux of the sinuses*, or *torcular Herophili* (plate XL. fig. 1, B; plate XLI. fig. 1, b): its form is very irregular. If a square piece of bone be removed, and the dura mater laid open at the point above referred to, the apertures of the following sinuses will be observed opening into it:

The superior Longitudinal sinus (plate XL. fig. 1, A, A; sinus longitudinalis; s. falciformis superior), commencing at the crista galli, extends from before backwards, in the upper border of the falx, gradually increasing in size as it proceeds. Across its cavity, which is triangular, several bands (*chordæ Willisii*; fig. 4, c, c) extend obliquely. The veins from the cerebral surface open into this sinus in such a way that the apertures of the greater number of them are directed from behind forwards (fig. 4, a, a), contrary to the direction of the current within it; so that though regurgitation may take place into the sinus, it does not follow that it shall extend into the brain, as the blood in the sinus, by its pressure, will close the mouths of the veins, by reason of the peculiar arrangement just noticed.

The inferior Longitudinal sinus (plate XL. fig. 1, c, c; s. longitudinalis inferior, s. falciformis inferior) is very small, and circular in its form; its diameter is inconsiderable. Placed in the inferior concave border of the falx, it runs from before backwards, and opens into the straight sinus on reaching the anterior margin of the tentorium.

The Straight sinus (plate XL. fig. 1, e; s. rectus, s. quartus, s. tentorii) may be considered as the continuation of the inferior longitudinal sinus; it runs backwards in the direction of the base of the falx cerebri, gradually widening as it approaches the conflux, where it terminates. Its form is triangular; some transverse bands cross its interior. Besides the inferior longitudinal sinus, the *venæ Galeni* and the superior veins of the cerebellum open into it.

The Lateral sinuses (plate XL. fig. 1, C; plate XLI. fig. 1, c, c; s. laterales, s. transversi) are of considerable capacity. Their direction conforms to that of the groove marked along the interior of the occipital bone, from opposite the internal occipital protuberance to the foramen lacerum posterius. The sinus of the right side is usually larger than that of the left; both commence at the conflux, and terminate at the outlet just noticed, where they are continuous with the jugular veins. In addition to the blood transmitted from both the longitudinal sinuses, from the straight and occipital sinuses, they also receive that of the veins which arise from the sides and base of the brain, and also from the under surface of the cerebellum.

The posterior Occipital sinus (plate XL. fig. 1, h; plate XLI. fig. 1, s; s. occipitalis posterior) is sometimes a single canal, not unfrequently double, as if composed of two compartments. It lies along the attached border of the falx cerebelli, extending from the posterior margin of the foramen magnum to the conflux.

The sinuses placed at the base of the skull are as follows, taking them in their order from before backwards:

The Circular sinus (plate XLI. fig. 1, n, o; s. circularis, s. coronoideus, s. Ridley).—The name expresses its form; its position is round the margin of the pituitary fossa. It is not always a complete ring, as it represents sometimes a semicircle, placed usually before the gland, sometimes behind it. This little reservoir takes up the blood from the pituitary body by minute veins. It communicates at each side with the cavernous sinus.

The Cavernous sinuses (plate XLI. fig. 1, m, m; s. cavernosi) are two in number, placed at the sides of the body of the sphenoid bone, and of a very irregular form, but of considerable size. Each receives the ophthalmic vein at its fore part, communicates internally with the circular sinus, and posteriorly with the petrosal sinuses. The name given to this sinus seems to have been adopted from the winding complex appearance which its interior presents. The dura mater at the side of the body of the sphenoid bone divides into two layers; one of these rests on the bone, whilst the other is stretched from the margin of the sphenoidal fissure backwards, to the upper border of the pars petrosa; so that they leave an interval between them, constituting the sinus. The membrane which lines the ophthalmic vein and the circular sinus, when prolonged into the cavity now under consideration, is considerably dilated; it is intimately connected with that layer of the dura mater which forms the inner wall of the sinus, but is separated from the outer one by an interval which lodges the carotid artery, with the third, fourth, ophthalmic division of the fifth, and the sixth nerves.

The superior Petrosal sinus (plate XL. fig. 1, f; plate XLI. fig. 1, r: s. petrosus superior) represents a narrow canal, running along the upper angle of the pars petrosa. Commencing at the posterior part of the cavernous sinus, its direction is outwards and backwards in the attached margin of the tentorium cerebelli; it descends a little, and ends in the curved part of the lateral sinus, where it lies upon the temporal bone.

The inferior Petrosal sinus (plate XL. fig. 1, g; plate XLI. fig. 1, p: s. petrosus inferior) at its inner extremity is near to the preceding; it passes outwards, and a little downwards, taking the direction of the inferior angle of the pars petrosa, where it is in apposition with the basilar process of the occipital bone; it opens into the lateral sinus near its termination.

The Occipital sinus (plate XLI. fig. 1, q; s. occipitalis anterior, s. basilaris).—This is placed at the fore part of the basilar process of the occipital bone, extended transversely, so as to establish a communication between the sinuses just described; for its extremities are connected with both the petrosal and the cavernous sinuses of each side.

The Ophthalmic vein (plate XLI. fig. 1, e; v. ophthalmica).—This vessel may be placed in connexion with those of the cranial cavity, as it opens into the cavernous sinus. Its branches and radicles ramify in the different structures contained within the orbit, in company with the branches of the ophthalmic artery. Minute ramifications arise from the palpebræ (g, g), where they communicate with those of the angular vein; those which accompany the supra-orbital artery have similar connexions with the external veins of the forehead. These pass backwards, converging to form others of larger size. The branches arising from the lachrymal gland, from the different muscles, from the ethmoidal cells, those from the globe of the eye itself, all taking the names of the arterial branches which they accompany, join to form a short single trunk, which leaves the orbit by the inner part of the sphenoidal fissure, and terminates in the cavernous sinus.

Veins of the Diploë (plate XLI. fig. 2; venæ ossium cranii).—In order to demonstrate the position and direction of the veins of the diploë, detach the pericranium, and remove the external table of the skull by carefully filing it away; the vessels thus named will then be brought into view. Lodged in grooves hollowed in the bone, their ramifications form a series of irregular areolæ, from which a few larger vessels issue. These are directed downwards at different parts of the circumference of the cranium, and terminate, partly in the veins on the outer surface of the bones, partly in the lateral sinuses of the dura mater.

OF THE VEINS WHICH FORM THE INFERIOR VENA CAVA.

These consist of the vessels which return the blood from the lower extremity, from the viscera of the pelvis and of the abdomen. The veins of the lower extremity, as in other parts of the body, are divisible into two sets, of which one is deeply seated, whilst the other runs superficially between the common integument and fascia. Immediately under the integuments on the dorsum of the foot there exists a series of small veins disposed in meshes; from these issue two principal trunks (saphenous), which are named, from their relative position, internal and external, or, from their relative length, the greater and smaller.

The internal Saphenous vein (plate XLIII. fig. 1, A ; v. saphena major, vel interna) extends from the ankle to within an inch and a half of Poupart's ligament ; in this course it lies superficially between the integument and fascia. Taking rise from the plexus previously indicated, it passes upwards in front of the inner malleolus, and thence along the corresponding border of the tibia, accompanied by the internal saphenous nerve. At the knee, the vein inclines a little backwards, as it passes by the internal condyle, after which it ascends along the inner and anterior side of the thigh, and terminates in the femoral vein, after passing through an aperture in the fascia lata, which, from this circumstance, has been termed the saphenous opening. It is joined in this long course by numerous cutaneous branches, and near its termination receives the *superficial epigastric* (fig. 1, a), *superficial circumflex ilii* (b), and *pudic veins* (c, c) ; the former passing down from the abdomen between the lamellæ of the superficial fascia, the latter from the groin and pubes.

The external Saphenous vein (plate XLIII. fig. 2, A ; v. saphena externa, vel minor) proceeds from the outer side of the dorsum of the foot, and passes behind the outer ankle, gradually inclining backwards to the tendo Achillis. Passing along the border of the tendon, it gets on the belly of the gastrocnemius muscle, on which it ascends, accompanied by the external saphenous nerve, with which it runs between the heads of the gastrocnemius, and pours its contents into the popliteal vein.

The deep veins of the lower extremity accompany the arteries and their branches, following exactly their distribution. Those below the knee being for the most part disposed in pairs, and presenting the disposition described in the corresponding veins of the upper extremity, are named the *venæ comites* of the vessels with which they are associated. The venæ comites of the arteries of the leg, namely, the anterior and posterior tibial veins (the latter having previously received the peroneal), unite near the lower border of the popliteus muscle, and form by their junction the popliteal vein.

The Popliteal vein (plate XLIII. fig. 2, B ; v. poplitea).—The popliteal vein, thus formed, receives branches corresponding with the articular vessels ; but its chief branch is the external saphenous vein. In its course through the ham, the popliteal vein is placed posterior and exterior to the artery, that is to say, between it and the nerve. Thus situated, it passes up through the aperture in the adductor magnus, and becomes continuous with the femoral vein.

PLATE XLII.

The superior and inferior cava and azygos veins are here shown. The dissection required to procure this view consists in removing the whole anterior part of the thorax and abdomen, together with the viscera.

No. 1. The thyroid gland. 2. The trachea. 3, 3. The bronchi. 4, 4. The divided sterno-mastoid muscles. 5, 5. The lower belly of the omo-hyoid muscles. 6, 6. Part of the trapezius muscle at each side. 7, 7. The divided clavicle at each side. 8, 8. The deltoid muscles. 9, 9. The divided pectoralis major at each side. 10, 10. The divided pectoralis minor. 11, 11. The cut serrations of the serratus magnus muscle. 12, 12. The cut extremities of the ribs. 13, 13. The kidneys. 14, 14. The renal capsules. 15, 15. The crest of the ilium at each side. 16, 16. The divided abdominal muscles. 17, 17. The iliacus internus muscle at each side. 18, 18. The anterior superior spinous processes of the ilium. 19, 19. The tensor vaginæ muscle at each side. 20, 20. The recti muscles. 21, 21. The sartorius muscle at each side. 22. Part of the psoas muscle at the right side ; on the left it is entirely removed. 23, 23. The pectinei muscles. 24, 24. The adductor longus muscle at each side. 25. The symphysis pubis. 26. The cavity of the pelvis.

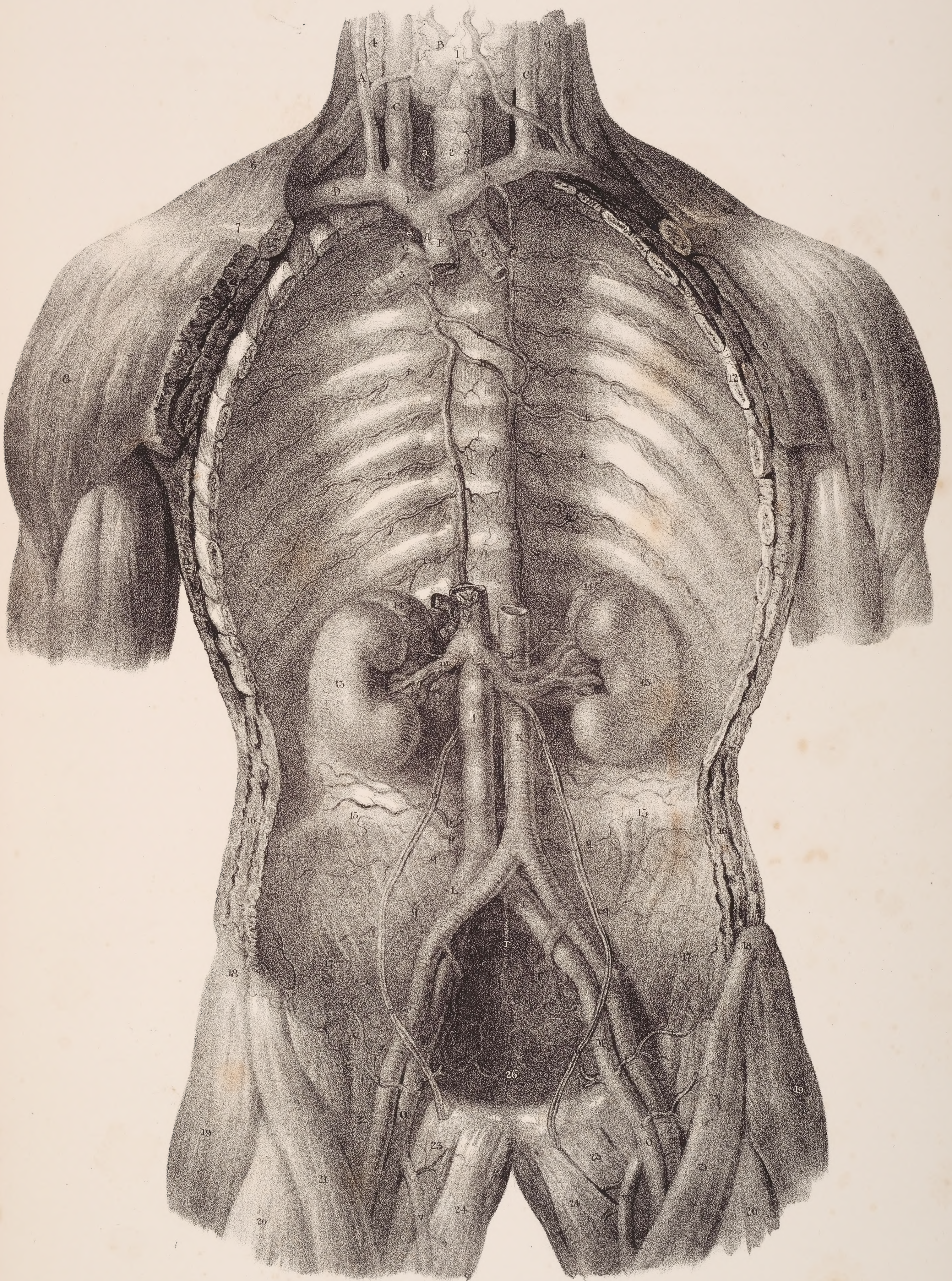
A, A. The external jugular veins. B, B. The anterior jugulars. C, C. The internal jugular veins. D, D. The subclavian veins. E, E. The venæ innominatæ. F. The superior vena cava. G, G. The greater vena azygos (v. azygos major). H, H. The lesser vena azygos (v. azygos minor).

a, a. The inferior thyroid veins. b. The superior intercostal vein (v. intercostalis superior), formed by, c, c, the five superior intercostal veins of the left side. d, d. The bronchial veins (v. bronchiales). e, e. A venous trunk formed by the union of the two upper intercostal veins of the right side. f, f. The posterior intercostal veins of the right side (v. intercostales posteriores). g. The sixth intercostal vein crossing the fifth dorsal vertebra to terminate in the vena azygos of the right side. h. Posterior intercostal veins of the left side.

I. The inferior vena cava (v. cava inferior). K. The abdominal aorta. L, L. The common iliac veins (v. iliacæ communes). M, M. The external iliac veins (v. iliacæ externæ). N, N. The internal iliac vein (v. iliaca interna) of the right side. O, O. The femoral veins (v. femorales).

i, i. The termination of the phrenic veins (v. phrenicæ inferiores.) k, k. The hepatic veins (v. hepaticæ). l, l. The capsular veins (v. capsulares). m, m. The renal veins (v. renales vel emulgentes). n, n. Spermatie veins (v. spermaticæ) of the right side, opening into the inferior vena cava. o, o. Left spermatie veins terminating in the left renal vein. p, p. Lumbar veins (v. lumbales). q, q. Muscular branches distributed to the iliaci interni muscles. r. The middle sacral vein (v. sacra media). s, s. Divided trunks of the epigastric veins. t, t. The circumflex ilii veins. v, v. The internal saphenous veins.

Plate 42.



W. J. B. Wilson imp.

J. Walsh sc.

Wm Fairland lit.

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Fig. 1.

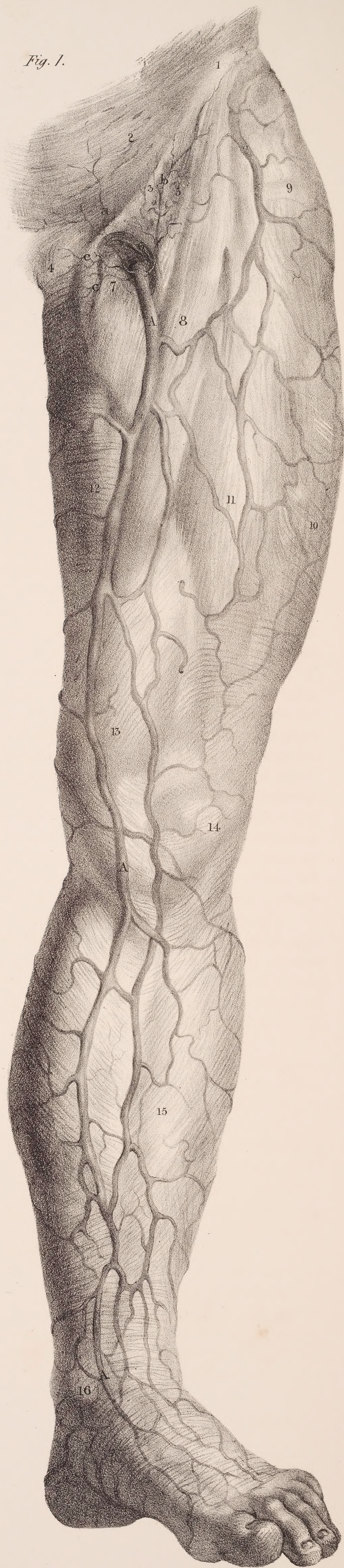


Fig. 2.



The Femoral vein (plate XLII. O ; v. femoralis) extends, like the artery which it accompanies, through the upper two-thirds of the thigh. Placed at first behind that vessel, it gradually inclines inwards and forwards, so that on reaching Poupart's ligament (where it terminates in the iliac vein) it lies on the inner side, and on the same plane as the artery, being separated from it only by a slight lamella that passes from before backwards, across the membranous tube which invests them. In the lower part of its course, the vein receives all the venous branches which accompany the ramifications of the arteries. In the upper part, the profunda vein opens into it, which returns the blood from all that part of the muscular structure of the thigh supplied by the profunda artery ; and near its termination it is joined by the internal saphenous vein.

External Iliac vein (plate XLII. M ; v. iliaca externa).—The femoral vein, placed at the inner side of the artery, enters the abdomen through the femoral ring, and assumes the name of *external iliac vein*. This vessel, lying at first on the inner side, and on the same plane with the artery of the same name, gradually inclines somewhat behind it as it approaches the sacro-iliac symphysis, where it joins the internal iliac vein, to form with it the common iliac vein. Near its commencement at Poupart's ligament, the external iliac receives the circumflex ilii and epigastric veins.

Internal Iliac vein (plate XLII. N ; v. iliaca interna).—All the branches of the internal iliac artery are accompanied by veins except the umbilical, whose corresponding vein passes in the foetus upwards to the liver ; these several veins give rise to the internal iliac. The vessel thus formed lies behind the corresponding artery in front of the sacro-iliac symphysis, and, after a very short course upwards to the margin of the pelvis, joins with the external iliac vein. It returns the blood from the organs contained within the pelvis, and from the large mass of muscles which occupy its outer surface. The branches of this vein being remarkable for their size and their frequent interlacings one with the other, they have been described as forming a series of plexuses, severally named from the organs on whose surface the interlacement occurs : thus the vesical, hæmorrhoidal, or uterine plexus, are not unfrequently mentioned. The only branch which requires more detailed notice is that named vena dorsalis penis in the male. This vessel is of considerable size. Commencing by a series of ramusculi which issue from the glans penis, we find in the first instance one at each side of the median line, in the dorsal groove of the penis : here they communicate with branches which accompany the internal and external pudic arteries. Proceeding backwards, they unite and form a short trunk which passes under the compressor muscle, and enters the pelvis beneath the sub-pubic ligament. Here it divides, its branches from thence passing obliquely downwards and backwards over the prostate and neck of the bladder, where it anastomoses with branches of the vesical veins, forming a sort of plexus, and finally opens into the internal iliac vein.

The common Iliac vein (plate XLII. L ; v. iliaca communis), formed by the confluence of the two iliac veins, passes upwards, converging towards the corresponding vessel of the opposite side, and both unite at the junction of the fourth with the fifth lumbar vertebra, a little to the right of the middle line, where they terminate in the inferior or ascending cava. The right is shorter, and nearly vertical in its direction, and both pass under the right common iliac artery.

The inferior Vena Cava (plate XLII. I ; v. cava inferior) returns the residue of the blood circulated

PLATE XLIII.

The superficial veins of the lower extremity.

Fig. 1. The internal saphenous vein, with its ramifications, seen upon the anterior and inner aspect of the leg and thigh.

No. 1. The anterior superior spine of the ilium. 2. The superficial fascia of the abdomen. 3. Poupart's ligament. 4. The spine of the pubis. 5. The iliac portion of the fascia lata perforated by holes for the passage of superficial vessels and lymphatics. 6. The falciform border of the saphenous opening. 7. The pubic portion of the fascia lata. 8. The projection formed by the sartorius muscle. 9. The projection of the tensor vaginæ femoris muscle. 10. The projection of the vastus externus. 11. The situation of the rectus muscle. 12. The adductor muscles. 13. The bellying of the vastus internus. 14. The patella. 15. The cutaneous surface of the tibia. 16. The inner ankle.

A, A. The internal saphenous vein (v. saphena interna, vel major).

a. The superficial epigastric vein (v. epigastrica superficialis). b. The superficial circumflex ilii vein (v. circumflexa ilii superficialis). c, c. Superficial pudic veins (v. pudicæ superficiales).

Fig. 2. The posterior and external aspect of the leg, showing the ramifications of the external saphenous vein.

No. 1. The inner hamstring. 2. The outer hamstring. 3. The popliteal fascia. 4, 4. The heads of the gastrocnemius muscle. 5. The external ankle.

A, A. The external saphenous vein (v. saphena externa, vel minor.) B. The popliteal vein (v. poplitea).

by the abdominal aorta. It commences at the conflux of the two common iliac veins on the side of the fourth lumbar vertebra, and thence ascends along the right side of the aorta, as far as the posterior border of the liver; it there becomes lodged in a groove in that organ, after which it inclines forwards to reach the opening in the diaphragm appropriated to it, and immediately terminates in the right auricle of the heart. In its course it receives the veins corresponding with the renal, lumbar, and middle sacral arteries; also the inferior phrenic, capsular, and spermatic; and finally, the hepatic veins, which, through the medium of the vena portæ, return the blood from the chylopoietic viscera. In a case reported by Meckel,* the inferior vena cava followed the course usually taken by the azygos vein, and terminated in the superior cava. The hepatic veins united into a single trunk, which assumed the ordinary position of the inferior vena cava, passed through its foramen in the diaphragm, and opened into the right auricle.

The middle Sacral vein (plate XLII. r; v. sacra media).—This vein, taking its course upwards on the anterior surface of the sacrum, opens into the commencement of the vena cava, or sometimes into the left common iliac vein as it crosses that bone.

The Lumbar veins (plate XLII. p, p; v. lumbales) commence by small branches in the muscles of the back and abdomen, where they communicate with the epigastric and other veins in the neighbourhood; arrived at the spine, they proceed forward behind the psoas muscle, those on the left side passing also behind the aorta, and terminate in the vena cava. Some of these veins are frequently found to unite into one trunk before their termination.

The Spermatic veins (plate XLII. n, o; v. spermaticæ).—Proceeding upwards from the testis, and forming one of the constituents of the spermatic cord, each spermatic vein enters the abdomen, and ascends on the psoas muscle behind the peritonæum. Below the external ring the veins are numerous, branched and convoluted; they have valves, but still may be injected from above downwards. These branches gradually unite, and form a single vessel, which opens on the right side into the vena cava, on the left into the renal vein. The spermatic veins sometimes bifurcate before their termination, each division opening separately; in this case, that of the right side may be found communicating with the vena cava and the renal vein.

The Renal veins (plate XLII. m, m; v. renales, vel emulgentes).—These veins are short, but of very considerable calibre. That of the left side is longer than the right, and passes generally in front of the aorta. They join the vena cava at nearly a right angle. The renal veins usually receive branches from the supra-renal capsules; the left has also opening into it the spermatic vein of the same side.

The Capsular veins (plate XLII. l, l; v. capsulares).—The veins of the supra-renal capsules are very small; they usually join on the right side with the vena cava, on the left with the renal veins.

The inferior Phrenic veins (v. phrenicæ inferiores) follow exactly the course of the arteries supplied to the diaphragm by the abdominal aorta.

VEINS OF THE LIVER.

In the adult, as well as in the fœtus, the veins of the liver present peculiarities which in a manner mark them off as a separate compartment of the venous system; for here a vein seems to assume the functions of an artery, and to convey the materials from which the peculiar secretion of the organ is elaborated. The *vena portæ*, or vein of the gate, has been so called from its entering the transverse fissure of the liver, which was likened to a gateway, the minor lobes placed before and behind it representing its pillars. This vessel conveys to the liver the residual blood from all the chylopoietic viscera. The veins from these different sources unite into two principal trunks, viz. the splenic and superior mesenteric; from the conflux of these proceeds the vena portæ, which again spreads out and ramifies in the liver, so that it may be said to have two sets of branches, viz. the incipient in the intestines, and the terminal in the liver, both being connected by an intermediate trunk.

The Splenic vein (plate XLIV. B; v. splenica) is a vessel of very considerable size, for it returns the blood not only from the spleen, but also from the pancreas, duodenum, the greater part of the stomach and omentum, the left colon, and part of the rectum. It commences by five or six branches which issue separately from the fissure of the spleen, but soon join to form a single vessel. Its direction is then transverse from left to right, embedded in the substance of the pancreas, in company with the splenic artery, beneath which it is placed. On reaching the front of the spine it joins

* Med. Gaz. 1830.

the superior mesenteric vein, nearly at a right angle. It receives branches from the pancreas (*venæ pancreaticæ*; a, a), from the duodenum (*v. duodenales*), from the left extremity of the stomach, some of which, from the arteries they accompany, may be called *v. gastricæ*, or *vasa brevia* (c, c); also the two following, which require a more detailed notice:—

The inferior Mesenteric vein (plate XLIV. C, C; *v. mesenterica inferior*).—The branches of this vein correspond with the ramifications of the artery of the same name. They commence behind and at the sides of the rectum, from which they ascend and unite to form a single vessel, towards the sigmoid flexure of the colon. From this point it passes upwards and inwards along the lumbar region, behind the peritonæum, and runs between the transverse meso-colon and the spine; sometimes it lies farther to the left, but in either case it passes under the pancreas, so as to reach the splenic vein, in which it terminates.

The Coronary vein of the stomach (plate XLIV. e; *v. coronaria ventriculi*).—This vein lies parallel with the artery of the same name. Its size is inconsiderable, and its direction transverse from the cardiac to the pyloric part of the stomach, along the lesser curvature. On reaching the latter point it turns downwards, and opens into the splenic vein, or in some instances into the trunk of the vena portæ.

The superior Mesenteric vein (plate XLIV. D, D; *v. mesenterica superior*) corresponds with the artery of the same name, lying to its right, and somewhat anteriorly, and returns the blood from the same parts, viz. the small intestine, and the ascending and transverse parts of the colon. The trunk formed by the union of these branches inclines upwards and to the right side, passing in front of the transverse part of the duodenum and behind the pancreas, where it joins with the splenic vein.

The Portal vein (plate XLIV. A; *v. portæ*).—The trunk of the vena portæ, commencing at the junction of the splenic and mesenteric veins, passes upwards, forwards, and a little to the right, to reach the transverse fissure of the liver, being about three inches in length. It comes into intimate relation with the biliary vessels, being placed closely behind, and in a manner between the hepatic artery and the hepatic ducts. It is surrounded by the filaments of the hepatic plexus of nerves, together with lymphatics. All these are embedded in loose cellular tissue, and enclosed within the layers of the gastro-hepatic omentum. When near to the right extremity of the transverse fissure, the vena portæ divides into two branches. That of the right side directly enters the substance of the corresponding lobe of the liver, and spreads out into branches, each of which is accompanied by a branch of the hepatic artery and of the hepatic duct. The left branch, which is smaller, but necessarily longer, passes across to gain the left extremity of the fissure, where it enters and ramifies like the preceding branch. The blood conveyed to the liver by this vessel is collected again, and returned into the current of the circulation by the hepatic veins.

The Hepatic veins (plate XLII. k, k; *v. hepaticæ*) commence by radicles, which communicate (as may be shown by injection) with the terminations of the vena portæ. These gradually enlarge as they pass upwards, converging to the point at which the vena cava passes behind the liver, and pour their contents into that vein. There are usually three sets, proceeding to a common point; those from the right and left lobes being oblique in their direction, those from the lobulus Spigelii and middle of the liver occupying an intermediate position.

The great vein of the Heart (plate XXXVII. a*; *v. cordis maxima*).—This vessel is of considerable size, and from the way in which it coils round the left side of the base of the heart, or rather of the ventricle, it may be named “coronary.” Its chief branch runs along the groove at the anterior convex surface of the heart, corresponding with the septum ventriculorum. Commencing at the apex, it gradually increases as it approaches the base of the ventricles, receiving branches from both, particularly from the left. It then inclines backwards, and to the left side, running in the groove between the left auricle and ventricle, but prolongs its course a few lines beyond this to open into the right auricle, close to the septum auricularum. In this course it receives branches from the ventricles, also from the left auricle; and when it passes by the thick margin of the left ventricle, it receives a vein of some size, which ascends to join it.

The middle Coronary vein (*v. cordis media*).—The term “coronary” cannot be applied to this vessel with any propriety, as its direction is altogether straight, running along the groove between the ventricles at the posterior surface of the heart. It commences by small branches at the apex, communicating with those of the preceding vein, ascends to the base, receiving ramusculi from the fleshy substance of both cavities, and opens into the vena maxima, near its termination.

The small Coronary veins (plate XXXVII. b*, b*; *v. cordis parvæ*).—Several small branches arise from the anterior surface of the right ventricle, from which they pass upwards and outwards, to

open separately into the right auricle, after having crossed over the groove which separates it from the ventricle.

Venæ cordis minimæ.—Under this name are included those minute vessels whose orifices are observable in the interior of the right auricle, which, from having been noticed by an old anatomist, Thebesius, are generally called *foramina Thebesii*.

PLATE XLIV.

In this plate the portal vein, formed by the venous trunks from the abdominal viscera, is shown.

- No. 1. The right lobe of the liver. 2. The lobulus quadratus. 3. The left lobe. 4. The lobulus Spigelii.
 5. The gall-bladder. 6. The cystic duct. 7. The hepatic duct. 8. The ductus communis choledochus.
 9. The stomach. 10. Its pyloric extremity; and, 11, the descending portion of the duodenum, the intervening portion having been removed. 12. The pancreas. 13. The spleen. 14. The ascending colon.
 15. The cæcum. 16, 16. The small intestine. 17. The descending colon; the transverse portion is removed. 18. The sigmoid flexure. 19. The commencement of the rectum.
 A. The portal vein (v. portæ). B. The splenic vein (v. splenica).
 a, a. Pancreatic veins (v. pancreaticæ). b. The pancreatico-duodenal vein (v. pancreatico-duodenalis). c, c. Gastric veins (v. gastricæ, vel vasa brevia). d. The gastro-epiploic vein (v. gastro-epiploica). e. The coronaria ventriculi vein.
 C, C. The inferior mesenteric vein (v. mesenterica inferior).
 f. The left colic vein (v. colica sinistra). g, g. Sigmoid veins (v. sigmoideæ). h. The superior hæmorrhoidal vein (v. hæmorrhoidalis superior).
 D. The superior mesenteric vein (v. mesenterica superior), lying to the right of, E, the trunk of the superior mesenteric artery.
 i. The divided trunk of the middle colic vein (v. colica media). k. The right colic vein (v. colica dextra).
 l. The ilio-colic vein (v. ilio-colica). m, m. The veins from the small intestines (v. colicæ).

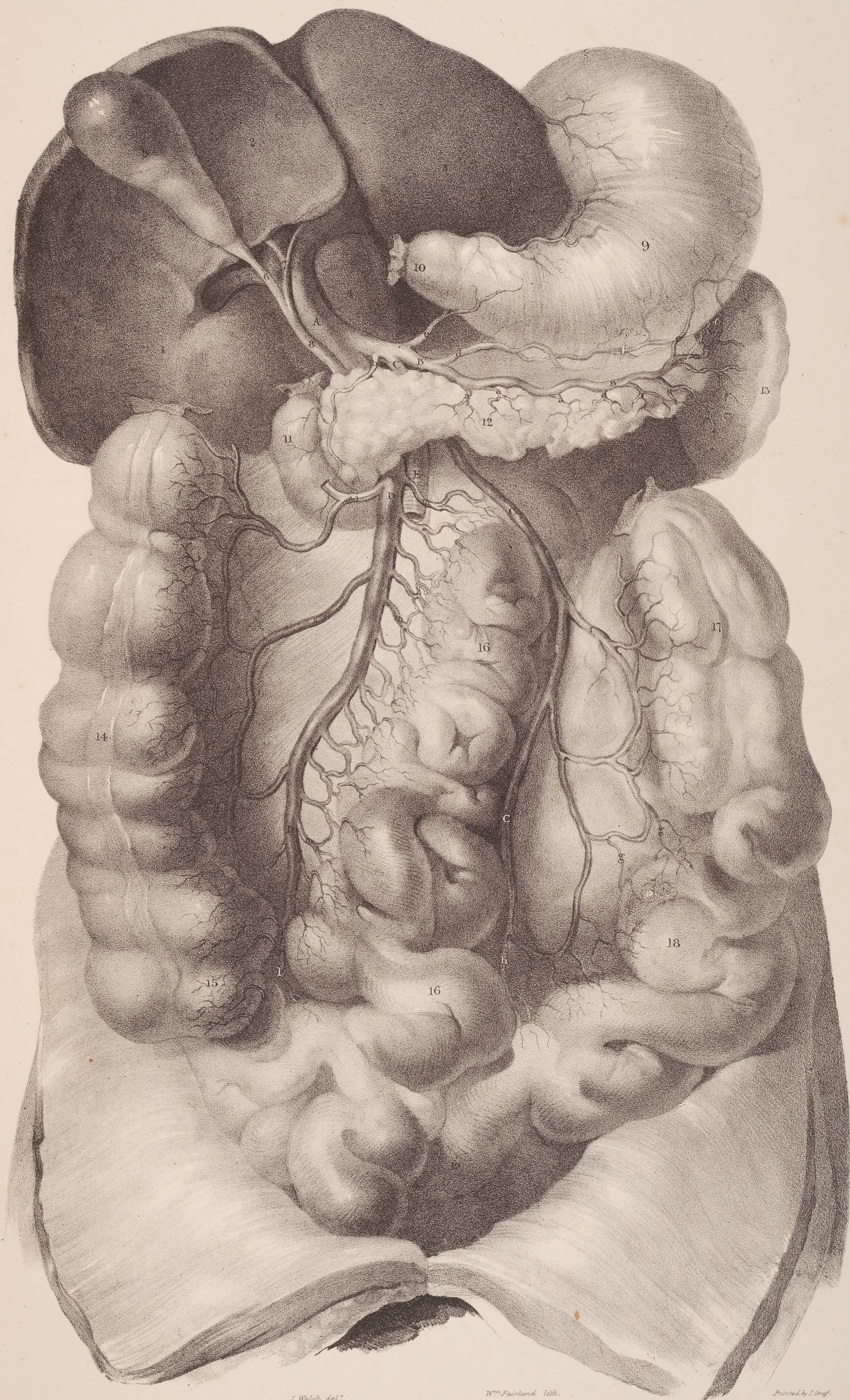
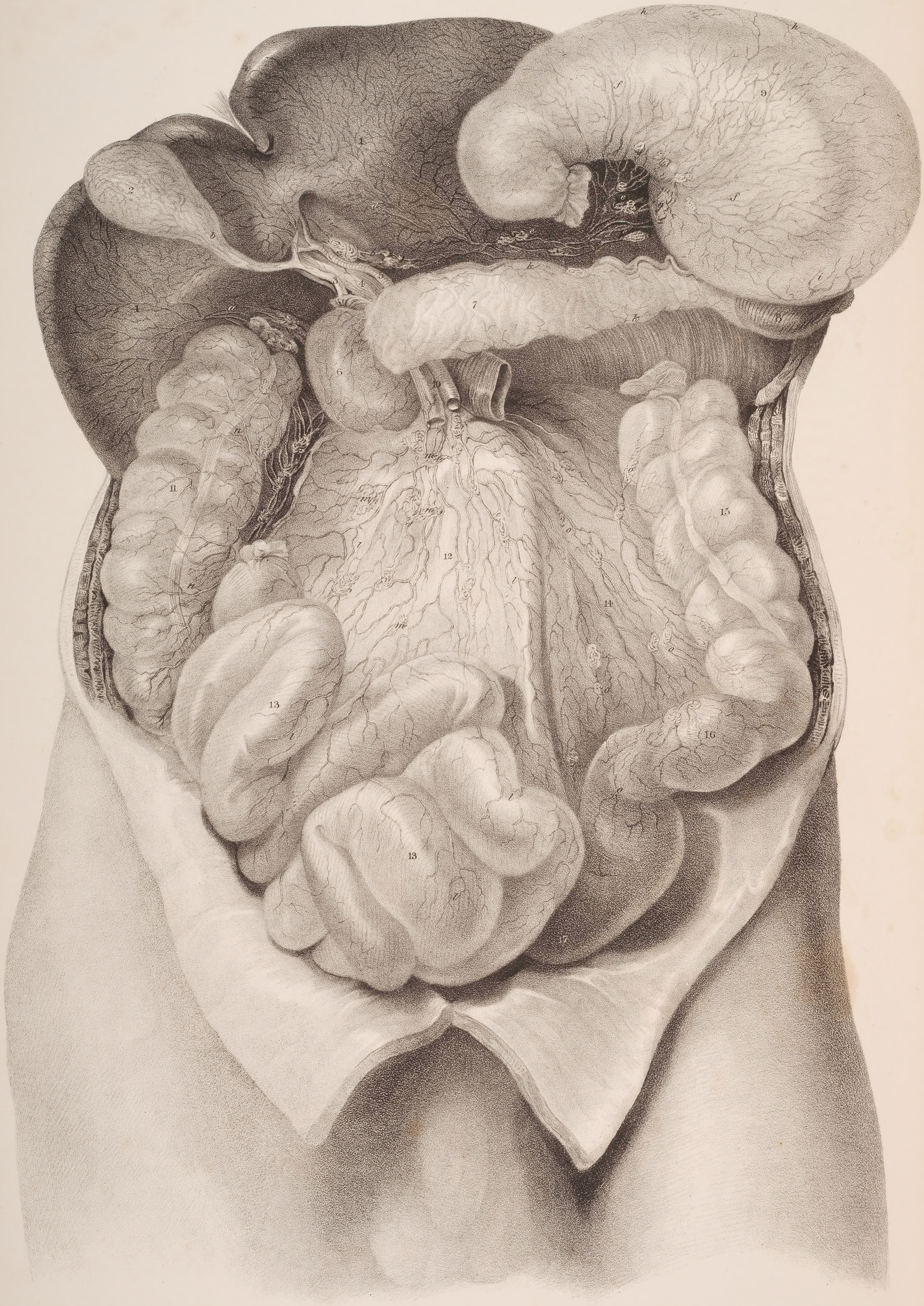


Plate 45.



W.J.E. Wilson delavit.

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CHAPTER III.

THE ABSORBENTS.

THE absorbing vessels, considered as a system or whole, are divisible into two sets: 1, those which return the chyle from the alimentary canal; and 2, those which take up the lymph or residue of nutrition from all the other parts of the body: both are connected in their course with ganglia or glands. We shall here describe their course and position, and in an outline of the general anatomy of absorbents, indicate their conformation and structure. The chyle vessels, by their union, form a large trunk (thoracic duct), which is a common reservoir for receiving their contents, as well as those of the lymphatics, which come—from both the lower extremities,—from the cavity of the abdomen and its viscera, except the right lobe of the liver,—from the walls of the abdomen at both sides, and from the surface of the left side of the thorax,—from the left lung, the left side of the heart, and left side of the diaphragm,—from the left upper extremity, and from the corresponding side of the head and neck. But the lymphatic vessels which arise from the right upper extremity, the right side of the head and neck, from the right lung, and from the corresponding half of the liver and diaphragm, pour their contents, by a short trunk, into the conflux of the right subclavian and internal jugular veins. This vessel may be called the right lymphatic duct; it is commonly named the right thoracic duct, though no part of it lies within that cavity. The duct of the left side is not entirely thoracic; for its commencement is in the abdomen, and its termination in the neck.

Vasa lactea, vel chyliifera. The lacteal vessels, plate XLV. l, l.—These vessels commence in the intestinal canal, from which they extend to the thoracic duct, in which they all terminate. They are much more numerous in the small intestine than in the large; hence they exist in greatest number in the mesentery, particularly in that part of it which corresponds with the jejunum and duodenum. We find two sets of these vessels along the tube of the intestine, taking a different direction, and lying on different planes. One runs longitudinally in the course of the canal, lying beneath its peritonæal coat; whilst the other, placed between the muscular and mucous coats, is transverse, being directed

PLATE XLV.

Lymphatic vessels of the abdominal viscera.

This view is obtained by raising the liver, and drawing the stomach upwards and outwards. Part of the duodenum and small intestine, and the transverse colon, are removed, and the anterior layer of the mesentery dissected away.

Nos. 1, 1. The under surface of the liver. 2. The gall-bladder. 3. The ductus communis choledochus. 4. The portal vein. 5. The hepatic artery. 6. The descending portion of the duodenum. 7. The pancreas. 8. The lower part of the spleen projecting below the great end of the stomach. 9. The stomach. 10. The superior mesenteric artery and vein, resting upon the transverse portion of the duodenum. 11. The ascending colon. 12. The mesentery. 13. The small intestines. 14. The layer of peritoneum which connects the descending colon to the posterior wall of the abdomen. 15. The descending colon. 16. The sigmoid flexure. 17. The rectum.

a. A group of lymphatics from the right lobe of the liver, passing to its posterior border to terminate in the commencement of the thoracic duct. b, b. A second group from the gall-bladder and middle portion of the liver, proceeding along the course of the hepatic vessels between the layers of the lesser omentum. c One or two lymphatic trunks passing to the upper surface of the liver. d, d. Lymphatics from the left lobe passing to the coronary glands, e, e. f, f. Lymphatics from the stomach converging to the group of glands, g, g, placed along the concave border of the organ. h, h. Lymphatics converging to the glands on convex border of the stomach. i. Lymphatics from the great end of the stomach descending to the splenic glands. k, k. Pancreatic lymphatic vessels. l, l. Lacteal vessels originating upon the surface of the small intestine, and converging to the root of the mesentery. m, m. Mesenteric glands. n, n. Lymphatic vessels from the ascending colon, terminating in glands along its fixed border. o, o. Lymphatics and glands from the descending colon, converging towards the vertebral column and root of the mesentery.

from the intestine along with its nutritious vessels, and, like them, enclosed within the folds of the peritonæum. It was at one time supposed that the superficial absorbents here noticed were lymphatics, and that the others were lacteals; the distinction, however, is not tenable: both seem to communicate and anastomose. "The lacteals (says Cruikshank) absorb chyle when it is presented to them; and at other times they absorb other fluids."* The deep-seated lacteals, when they enter the mesentery, take the course of the vessels, passing through the lymphatic glands, of which many are placed within its folds. They gradually unite as they proceed, two or three perhaps converging to form one; and so they become diminished in number, until finally, towards the root of the mesenteric artery, two or three trunks shall have resulted from the junction of all. Sometimes, however, six or seven of these vessels open separately into the commencement of the thoracic duct. In this way the lacteals, from the whole of the small intestine and from the cæcum, together with the ascending and transverse parts of the colon, terminate; those from the descending colon and its sigmoid flexure usually join some of the lumbar lymphatics, or turn upwards, and open by a single vessel into the lower end of the duct. To the same point we trace, from below upwards, the lymphatic vessels, from the two lower extremities; so that the thoracic duct may be said to commence at the conflux of those just named with the common trunk of the lacteals.

The absorbents are called also lymphatics, *vasa lymphatica*, absorbent system, système absorbant. —The term "absorbent" means, literally, sucking up; and is used to denote the property (ascribed to certain vessels found very generally diffused throughout the system) of imbibing substances placed in contact with them, and carrying them into the current of the circulation. Under this head are included two sets of vessels, together with a number of nodular bodies of various forms and sizes, called glands; these are situated in the course of the vessels, and are appended to them. The vessels are transparent, their coats being very thin, and appear white when filled with their fluid contents during life; they are very small, and increase but little in size by the conflux of branches; so that they cannot be said to present an arborescent form, like arteries and veins; they rather resemble a diffused net-work, and when artificially injected look like jointed cords.

Lymphatics and lacteals.—From a difference in the nature of the fluid which the absorbent vessels contain, they are divided into two orders, viz. lymphatics and lacteals. The latter are confined to the cavity of the abdomen, and only absorb chyle, the product of digestion; the former are diffused through the body at large, and are engaged in that process of absorption which is constantly going on in the various structures of which it is composed.

Glands.—In different parts of the course of the absorbing vessels, rounded or oval bodies are situated, called *glands* (*lymphatic* or *conglobate*), which in the extremities are found usually at the flexures of joints, but in the cavities are variously disposed. The vessels, as is evident from the results of injection, on arriving at the glands, become intimately connected with them, and in a manner ramify through their interior; for if some quicksilver be introduced into the vessel, it will soon permeate the whole substance of the gland.

Inferent and efferent vessels.—The entering vessels are on this account called "*vasa inferentia*." The vessels which issue from the glands appear to arise from their interior by a number of minute radicles, which unite to form tubes, of about the same size as those which had entered at the opposite side. These pass on in the course of the circulation; and as they convey away whatever fluids had passed through the glands, they are called "*vasa efferentia*." It should be observed, that anatomists are by no means agreed as to the precise distribution of the minute tubuli which are convoluted in the interior of the glands.

Thoracic duct.—All the chyloferous vessels, as well as all the lymphatics, which arise from the lower extremities, from the left side of the thorax, the left upper extremity, and the lateral half of the head and neck of the same side, pour their contents into a common trunk—the "left," or "great thoracic duct" (*ductus thoracicus sinister vel major*, Sœmm.) This is a tube similar in structure, but larger than those which open into it, which runs along the spinal column, from the second lumbar vertebra to the lower part of the neck, where it opens into the angle formed by the union of the left subclavian and jugular veins. The rest of the absorbents, consisting of those which return the lymph from the right upper extremity, from the right half of the thorax, and the corresponding side of the head and neck, terminate in a short trunk, the "right," or "small lymphatic duct," which opens into the junction of the right subclavian and jugular veins. These, it should be observed, are not the only points at which absorbents open into veins. Lippi has shown some of them terminating in the inferior cava, also in the iliac and renal veins.

* Anatomy of the Absorbing Vessels, p. 161.

Lymphatics for the most part follow the course of veins, and like them are divisible into two sets, one superficial, the other deep-seated. They are said to consist of only two coats, perhaps because the external or cellular one is too thin to be satisfactorily demonstrated. The internal coat, or lining membrane, like that of veins, is smooth, thin, delicate, and formed into folds which constitute valves that allow the contained fluid to pass freely towards the common trunk, but prevent its return. The knotted appearance presented by lymphatics when injected, is owing to the column of the mercury, or other substance employed, being interrupted by the valves. The proper coat, corresponding with that of veins, is dense, firm, and most probably fibrous, though it is not easy to demonstrate the fact, except in the thoracic duct of a horse, or of some large animal. It is slightly elastic, and appears to be irritable; for we observe the lacteals to contract, and force on their contents, when the mesentery is exposed in an animal while the process of digestion is going on.

Absorbents.—History. The vessels included under this head appear not to have been known to the ancients: their discovery may fairly be considered of modern date, and different parts of this order of vessels were traced out by different persons at different times. In 1563 Eustachius first saw the thoracic duct in the horse, and called it “*vena alba thoracis* :” he says that a great offset comes from the junction of the left subclavian and jugular vein (*magna quædam propago germinat*) ; that it was white, and filled with an aqueous fluid; that soon after its origin it divided into two branches, which soon unite again; that it runs down upon the left side of the vertebra, pierces the diaphragm, embraces the aorta, then widens, and finally terminates in a way which he could not explain,—“*obscurissimum finem mihi adhuc non bene perceptum obtinet*.”

The nature of this vessel was not understood by its discoverer, nor were any of its connexions by branches known until the year 1622, when Asellius, also an Italian anatomist, whilst looking at the movements of the diaphragm in the dog, saw some white lines running along the mesentery, which at first he took for nerves; but, having punctured them, a white fluid ran out, when they shrunk and became invisible. He thus ascertained that they were a new order of vessels, which were perceptible only when the intestines contained alimentary matter. He named them “*vasa lactea*,” and attributed to them the power of absorbing chyle from the intestinal canal; thus, to the three orders of vessels, arteries, veins, and nerves, known to exist in man and animals, Asellius added a fourth, the lacteals. “*Aliud est genus, quartum, novum, et ignotum hactenus, à me primo observatum*.”

Asellius made many dissections and experiments to satisfy a laudable curiosity as to the existence and nature of these vessels in other animals as well as in the dog. He tells us that seldom did a week pass, and never did a month pass, in which he did not perform some experiments; so that, during the progress of his researches, dogs, cats, lambs, hogs, sheep, and cows were offered up on the altar of science. He made one great offering which he commemorates as a great achievement: “*Quinetiam equus huic uni rei emptus, et vivus exenteratus*.”

Human dissection was not at that time practised; he therefore had no opportunity of seeing lacteals in the human subject; so that he gravely informs us, “*Hominem vivum, (quod tamen Herophilus et Erasistratus fecere,) numquam incidi fateor, nec incidam; nam nefas et morte piamdum cum Celso existimo præsidem salutis humanæ artem pestem alicui eam atrocissimam inferre*.”

As Asellius had no opportunity of demonstrating lacteals in the human subject, though he affirmed their existence from analogy, their existence was denied by most anatomists, who still continued to assert that chyle was taken up by the veins. Even Harvey adhered to the old doctrine: he seemed inclined to think that there was no necessity in searching after any new way for the chyle in adults besides that which exists in the egg, and in the chick, where the umbilical veins and arteries suffice.

It was in 1634 that the lacteals were first seen in the human subject by Verlingius, who described and figured them: he saw the lymphatics of the liver, and was the first who, since Eustachius, saw the thoracic duct; for all other anatomists, with Asellius, thought that the chyle vessels went to the liver.

The lymphatics were seen by Rudbeck, a Swede, about twenty-eight years after the discovery of the lacteals: he considered them a fifth set of vessels, and named them *vasa serosa*. About the same time Bartholin, a Dane, saw the lymphatics; but he must have learned a little of them from having edited the work of Verlingius: in 1653, they were first demonstrated in this country by Dr. Jolliffe.

If the lacteals and lymphatics be considered as parts of one system, all those persons whose names are thus connected with successive discoveries, may be considered as having traced out some additional parts rather than as having made distinct discoveries.

Additions were made from time to time to the discoveries here mentioned, which showed their existence in several of the lower animals. Mr. Hunter showed them in the crocodile and in the goose; Mr. Hewson in the turkey and in fishes; Bartholin also saw them in the globe-fish: still most persons, even up to the time of the Hunters, supposed them to be merely appendages to the veins.

The *thoracic duct* (plate XLVII.) is from eighteen to twenty inches long in the adult, for it extends usually from the second lumbar vertebra to the root of the neck. Its commencement, however, is often opposite the third lumbar vertebra; in some cases as high as the first, or even the last dorsal. Here there is usually a dilatation, which varies considerably in degree, being in some cases scarcely perceptible, in others considerable. This part of the duct is called *receptaculum chyli*: but the term is not well chosen, as it receives lymph as well as chyle; nor is it always applicable, for there may be no dilatation. It lies to the left side and behind the aorta, and is about three lines in diameter; but as it ascends it passes to the right side of that vessel, getting into contact with the right crus of the diaphragm, and so reaches the thorax, where it is placed at first upon the fore part of the dorsal vertebræ, between the aorta and the vena azygos major, the latter being to its right side. It ascends gradually inclining to the left, at the same time diminishing in size until it reaches the third dorsal vertebra, where, after passing behind the arch of the aorta, it comes into contact with the œsophagus, lying between its left side and the pleura. Continuing its course, it ascends into the neck, supported by the longus colli muscle, until it comes on a level with the upper border of the seventh cervical vertebra, where it changes its direction and comes forwards, at the same time inclining downwards and inwards, so as to describe a curve, previously to its termination at the external angle formed by the union of the subclavian and internal jugular veins. The duct does not always remain single in its whole extent; it frequently divides opposite the seventh or eighth dorsal vertebra into two branches, which unite again; sometimes in its course it separates into two or three branches, which afterwards unite, and enclose between them so many spaces or islets. Mr. Cruikshank in one case found the duct double in its entire length; "in another triple, or nearly so." When in the neck, it often divides into two or three branches, which in some instances terminate separately, but in others join again previously to their termination. At the junction of the duct with the veins there are two valves so placed as to prevent the entrance of any blood into the duct, and whilst they allow the chyle and lymph freely to pass into the veins, they effectually prevent their return into the duct. The diminution in the size of the duct as it ascends has been noticed; at the fifth dorsal vertebra it is often no more than about two lines in diameter, but above this point it enlarges again. It is generally waving and tortuous in its course.

Lymphatic vessels (vasa lymphatica).—We shall trace up the course of the lymphatic vessels which pour their contents into the thoracic duct, beginning with those of the lower extremities:—

The *lymphatics of the lower extremity* (plate XLVI.) present the same disposition as those of

PLATE XLVI.

Superficial lymphatics of the lower extremity.

Fig. 1. An anterior view of the leg and thigh; showing the superficial veins and lymphatic vessels resting on the deep fascia.

No. 1. The superficial fascia of the abdomen. 2. The anterior superior spine of the ilium. 3. The saphenous opening. 4. The convexity of the vastus internus muscle. 5. The patella. 6. The inner ankle.

A, A. The internal saphenous vein.

a, a. Lymphatic vessels accompanying the internal saphenous vein along the inner side of the leg and thigh.

b, b. The lower group of inguinal glands, receiving the lymphatics from below. c. Lymphatic vessels passing through the saphenous opening. d, d. Communicating vessels between the lower, and, e, e, the upper group of inguinal glands. f, f. Superficial lymphatic vessels from the gluteal region. g, g. Superficial abdominal lymphatics. h, h. Lymphatic vessels from the penis and scrotum. i, i. Several vessels that cross the front of the tibia from the outer to the inner side.

Fig. 2. Posterior aspect of the leg and thigh.

No. 1. The gluteus maximus. 2. The popliteal region. 3. The external ankle.

A, A. The external saphenous vein.

a, a. Lymphatic vessels accompanying the external saphenous vein. b, b. Lymphatics winding around the lower border of the thigh to the internal saphenous vein. c, c. Several vessels passing beneath the knee to join the internal saphenous lymphatics at the inner condyle. d. A superficial lymphatic ganglion situated just above the ham. e, e. Lymphatic vessels passing around the hip to the inguinal glands. f, f. Lymphatics from the gluteal region, destined to the inguinal glands.

Fig 2.



H. F. Wilson sculp.

Plate 46.

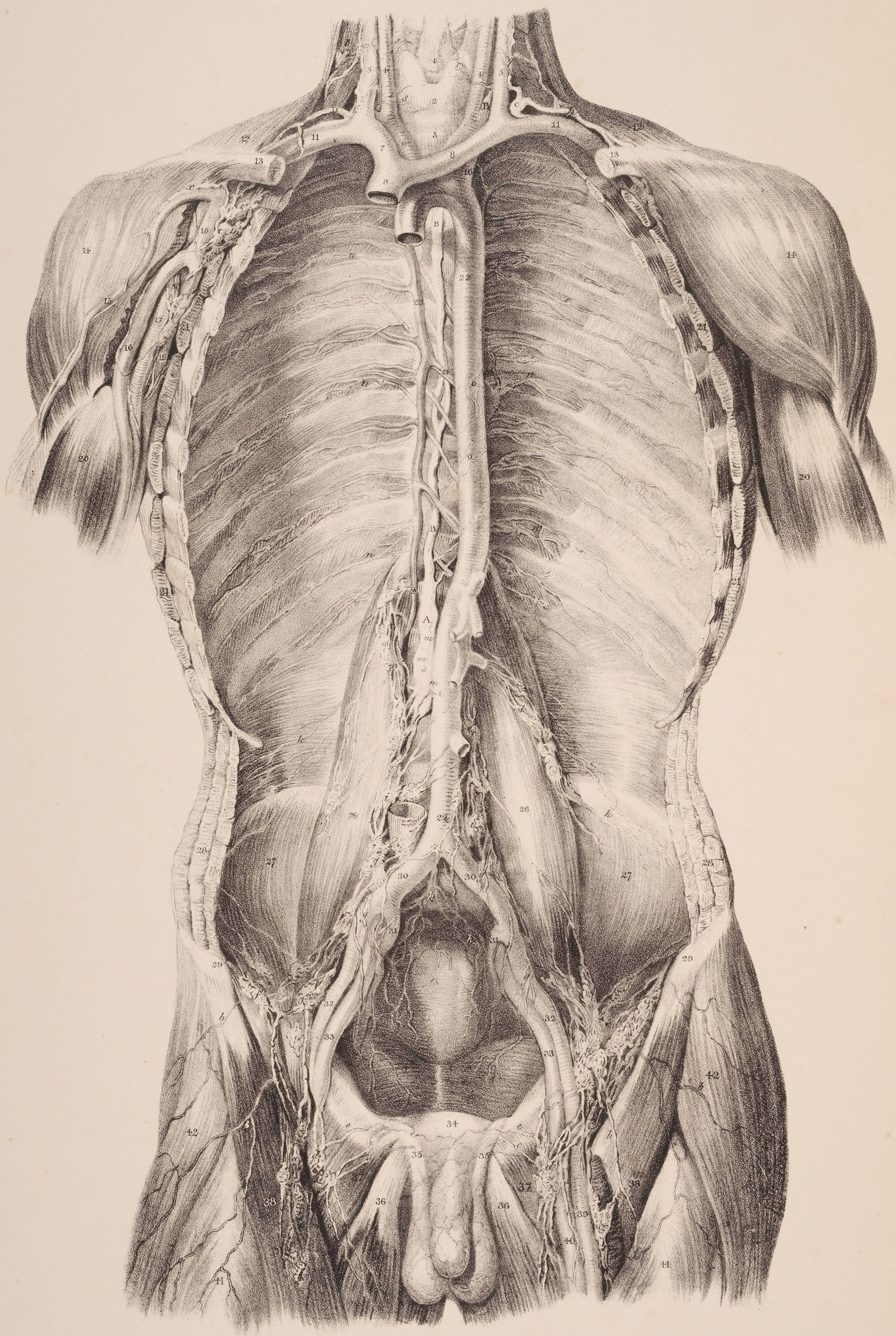
Fig 1.



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Plate 47.



J. H. Wilson direct.

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the upper. The superficial series, disposed between the integuments and fascia of the limb, are arranged into two sets, of which one accompanies the internal saphenous vein, the other following the course of the external. The vessels composing the first set take rise on the dorsum and inner side of the foot: passing partly in front and in part behind the internal malleolus, they ascend along the inner side of the knee and anterior surface of the thigh, and terminate in the superficial inguinal glands. In their course these vessels are joined by several branches proceeding from the integuments of the leg and the thigh. The lymphatics, which constitute the second division of the cutaneous series, are much less numerous than those just described. Commencing from radicles which occupy the outer margin of the foot, they pass behind the external malleolus, and ascend along the posterior part of the leg; here they get under cover of the fascia, and proceed between the heads of the gastrocnemius muscle to terminate in the popliteal glands. This course corresponds to that of the smaller saphenous vein, which these lymphatics accompany.

The deep-seated lymphatics, associated in their whole course with the arteries and their branches, consist in the leg of three divisions, namely, anterior tibial, posterior tibial, and peroneal. In the leg, neither these nor the superficial vessels meet with any lymphatic gland, with the exception of those accompanying the anterior tibial artery, which occasionally pass through one: this gland, when it exists, which is not always the case, is situated on the inter-osseous ligament, about the middle of the leg. The several sets of deep lymphatics here pointed out, after ascending with the blood-vessels, unite in the glands situated in the popliteal space. These (the popliteal lymphatic glands) are usually very small, and four or five in number; they surround the popliteal vessels, and are imbedded in a quantity of loose fat. The popliteal glands receive the deep-seated lymphatics of the leg, and those which accompany the external saphenous vein, and from them proceed vasa efferentia, which ascend with the femoral artery to the glands of the groin.

The inguinal glands, like the lymphatic vessels, are, from their relative position, divisible into a

PLATE XLVII.

Deep lymphatics of the trunk, with the course and relations of the thoracic duct. To obtain this view, the anterior wall of the thorax and abdomen has been removed, together with the viscera of those cavities.

No. 1. The larynx. 2. The thyroid gland. 3. The trachea. 4, 4. The common carotid arteries. 5, 5. The internal jugular veins. 6. The arteria innominata. 7. The right vena innominata. 8. The left vena innominata. 9. The superior cava cut short. 10. The left subclavian artery. 11, 11. The subclavian veins. 12, 12. Part of the trapezius muscle at each side. 13, 13. The clavicles, divided. 14, 14. The deltoid muscles. 15. The cephalic vein of the right arm. 16. The basilic vein. 17. The axillary artery. 18. The axillary vein. 19. One of the venæ comites. 20, 20. Part of the biceps muscle at each side. 21, 21. Line of section of the serratus magnus muscles. 22, 22. The aorta. 23, 23. The vena azygos major. 24. The vena azygos minor opening into the preceding. 25. The inferior vena cava, divided. 26, 26. The psoas magnus muscle at each side. 27, 27. The iliacus muscle at each side. 28, 28. The abdominal muscles, divided. 29, 29. The anterior superior spine of the ilium at each side. 30, 30. The common iliac arteries. 31, 31. The internal iliac arteries. 32, 32. The external iliac arteries. 33, 33. The external iliac veins. 34. The symphysis pubis. 35, 35. The spermatic chords. 36, 36. The adductor longus muscle at each side. 37, 37. The pectinei muscles. 38, 38. The sartorius muscle at each side. 39. The femoral artery of the left thigh. 40. The femoral vein. 41, 41. Part of the rectus muscle at each side. 42. The tensor vaginæ femoris muscle at each side.

A. The receptaculum chyli. B, B. The thoracic duct (ductus thoracicus). C. The thoracic duct curving downwards and forwards to terminate at the junction of the left jugular and subclavian veins.

a, a. Superficial lymphatic vessels and glands following the course of the saphenous vein. b, b. Superficial femoral lymphatics converging to the inguinal group of glands. c, c. Deep femoral lymphatic vessels and glands. d, d. Inguinal glands receiving, e, e, the lymphatic vessels of the penis and testes. f, f. Deep inguinal glands. g, g. Iliac lymphatic vessels and glands. h, h. Pelvic lymphatic vessels and glands. i, i. Lumbar lymphatic vessels and glands. k, k. Lymphatic vessels from the posterior wall of the abdomen converging to the lumbar glands. l, l. Large trunks by which the lumbar lymphatic vessels terminate in the receptaculum chyli. m, m. Divided trunks of the lacteal vessels. n, n. Intercostal lymphatic vessels converging to the chain of glands in the posterior mediastinum. o, o. Aortic lymphatic vessels. p. A large lymphatic trunk formed by the lymphatic vessels of the left upper extremity. q. Cervical lymphatic vessels converging towards the termination of the thoracic duct. r. Lymphatic vessels from the larynx and thyroid gland.

D. The right lymphatic duct (ductus lymphaticus dexter), terminating at the junction of the right jugular with the subclavian vein.

s, s. Lymphatic vessels from the right side of the larynx and thyroid gland converging to the right lymphatic duct. t. Cervical lymphatic vessels and glands. v. Axillary lymphatic vessels and glands. x. Lymphatic vessel accompanying the cephalic vein.

superficial and a deep set; the former being placed immediately under the integuments, the latter under the fascia lata. The superficial glands (plate XLVI. fig. 1. b, b, e, e) are larger than the others; their number varies much, but may be stated to average about eight or ten: they are disposed irregularly about Poupart's ligament and the saphenous opening of the fascia; a few sometimes extend for two or three inches downwards on the saphenous vein. The deep-seated glands (plate XLVII. d, d, f, f) are placed around the femoral artery and vein, immediately behind the preceding. In addition to the lymphatics of the inferior extremity already described, the inguinal glands are joined by some superficial vessels from the external generative organs, from the lower part of the abdominal parietes, and several which proceed from the integuments covering the outer side of the pelvis. The deep lymphatics, which are derived from the mass of the muscles on the pelvis, and many proceeding from the adductor muscles of the thigh, accompanying respectively the gluteal, sciatic, and obturator arteries, enter the cavity of the pelvis with these vessels, and proceed in a series of glands situated in the neighbourhood of the trunk by which the vessels are given off. The vasa efferentia of the superficial inguinal glands perforate the fascia, come into connexion with those situated deeply, pass into the abdomen by the side of the blood-vessels, and terminate in a chain of lymphatics lying along the external iliac artery, and communicating with the lumbar glands.

Lymphatics of the abdomen and pelvis (plate XLVI. fig. 1, g, g).—The lymphatic vessels of the abdominal parietes consist of several groups, proceeding in different directions, but all referable to the arteries supplied to the different regions. A superficial series, derived from the integuments covering anteriorly the lower part of the abdomen (from the umbilicus downwards), descends, converging to the superficial inguinal glands; and those deeply seated in the same situation, pursuing a similar direction, join glands situated on the external iliac artery, both following respectively the superficial and deep epigastric blood-vessels. The other lymphatics (plate XLVII. k, k), proceeding from the lateral and posterior part of the parietes of the abdomen, pass inwards between the fibres of the muscles; a small portion then winds round the crista of the ilium, meeting in their course one or two small glands, and proceed along Poupart's ligament with the circumflex ilii artery, to terminate in the external iliac glands; while the greatest number, directed backwards with the lumbar and ilio-lumbar arteries, and being joined by radicles from the large muscles of the back, pass behind the psoas muscle to the vertebral column, where they end in glands surrounding the large blood-vessels.

Lymphatics of the pelvic viscera.—The course of these, as of the lymphatic vessels in other parts, is indicated by that of their arteries and veins. The lymphatics of the bladder, taking rise from the entire surface of that organ, join the glands placed about the internal iliac artery: with these are associated the lymphatics of the prostate gland and of the vesiculæ seminales.

Those of the rectum are frequently of considerable size: immediately after leaving the intestine, some pass through small glands which lie contiguous to it; finally, they pass to glands situated in the hollow of the sacrum; some to those in the lumbar region.

In the unimpregnated state of the uterus, its lymphatics are small, but during the period of gestation they become of considerable size. Issuing from the entire substance of the organ, the greatest number descend, unite with those of the vagina, and passing backwards, join the internal iliac glands; thus pursuing the direction of the principal uterine blood-vessels. Others springing from the superior part (fundus) of the uterus, pass outwards in the folds of peritonæum which constitute its broad ligaments, and join with lymphatics derived from the ovarium and Fallopian tubes. The united vessels now ascend with the ovarium (in the male, spermatic) arteries, and, at a point where these take their rise, become connected with the lymphatics placed on the aorta and vena cava.

The *lymphatics of the penis* (plate XLVII. e, e) consist of superficial and deep sets, which pursue different courses. Those placed superficially usually form three vessels; two being placed laterally, the other superiorly. Commencing in the prepuce, they pass backwards, and generally unite on the dorsum penis, and again subdividing, send branches on each side to the inguinal glands.

The *lymphatics of the scrotum*, together with those from the integuments of the perinæum, may be associated; for all, guided, as it were, by the superficial pudic vessels, join the inguinal lymphatic glands. The deep-seated lymphatics of the penis accompany the internal pudic vessels, and unite with glands on the internal iliac artery. The lymphatics of the labia, clitoris, &c. in the female, present a disposition entirely similar to that here described in the male organs.

Lymphatics of the testis commence by radicles issuing from the substance of the testis, and from the tunica vaginalis. Collected into several trunks of considerable size, they ascend, with the other constituents of the spermatic cord, to the internal abdominal ring, and finally accompany the spermatic vessels to enter the large lumbar lymphatic glands.

Lymphatics of the kidney.—Those placed superficially are very indistinct; they become united with the deep-seated set, at the inner margin (hilus) of the kidney, from which they incline inwards to the lumbar glands. The lymphatics of the supra-renal capsules unite with those of the kidney. The lymphatic vessels of the ureter are numerous; they communicate with those of the kidney and the bladder, and for the most part terminate with the former.

Lymphatics of the stomach (plate XLV. f, g, h, i).—These at first are disposed into two planes, one lying under the peritonæal coat, the other between the muscular coat and the mucous lining; by taking the direction of the vessels they become aggregated into three fasciculi. One set takes the direction of the coronary artery, receiving, as it runs from left to right, branches from both surfaces of the organ, and at the pylorus turns backwards to join some of the larger trunks. Another, from the left extremity of the stomach, follows the vasa brevia, and unites with those of the spleen; whilst the third, guided by the right gastro-epiploic vessels, inclines from left to right along its great curvature, from which they pass backwards, and at the root of the mesentery terminate in one of the principal lacteal vessels.

Lymphatics of the spleen and pancreas (plate XLV. k, k).—Some of the lymphatics of the spleen lie immediately under its peritonæal covering, others in the substance of the organ. Both converge to the inner side of the spleen, come into relation with the blood-vessels, and accompanying them, pass through a series of small glands, and finally become connected with the lymphatics of the digestive organs.

Lymphatics emerge from the pancreas at different points, and join those last described.

The *lymphatics of the liver* (plates XLV. and XLIX.) are divisible into three principal sets—those upon its upper surface, those on the lower one, the third being diffused throughout its substance with the hepatic vessels. Those upon the upper surface, though spread out pretty equally upon it, incline in their course to different points, and so become distinguishable into groups, of which four are ordinarily enumerated. Thus, from the middle of the great lobe, five or six branches run obliquely upwards to the suspensory ligament, where they form a large trunk, which passes between the fibres of the diaphragm, behind the ensiform cartilage. When in the mediastinum, they pass along the chain of glands which accompany the internal mammary vessels, and so they are conducted to the root of the neck, generally at the right side, where they terminate in the lymphatic trunk of that side. The second group consists of vessels which incline upwards and outwards to the right lateral ligament, opposite to which they unite into one or two of larger size, which pierce the diaphragm, and run upon its convex surface to join the preceding trunk in the mediastinum. In some cases, however, these, instead of passing into the thorax, turn backwards and inwards on reaching the posterior border of the liver, and, running upon the crus of the diaphragm, open into the thoracic duct at its commencement. A similar fasciculus is formed upon the left lobe of the liver, which, after passing through the left lateral ligament, pierces the diaphragm, upon which they ascend to the glands above noticed. Finally, towards the lower sharp border of the liver, at each side, some vessels will be observed also to turn downwards and join those placed upon its under surface.

A diffused plexus is formed by ramifications upon the concave surface of the liver. On the right lobe they will be found running downwards over the surface of the gall-bladder to the transverse fissure, where some join the deep-seated set, and others, after passing through a few glands, are, as it were, guided by the hepatic artery to the right side of the aorta, where they terminate in the thoracic duct. Branches also proceed to the concave border of the stomach, between the folds of the small omentum, to join with the coronary lymphatics of the stomach.

The deep-seated lymphatic vessels of the liver accompany the ramifications of the vena portæ in the interior of the organ, from which they escape by the transverse fissure. After communicating with the superficial vessels, and also with those of the stomach, they pass backwards, and, at the side of the celiac artery, join with one of the lacteal trunks, previously to its termination in the thoracic duct.

Mesenteric glands (plate XLV. m, m).—These bodies vary in number from one hundred and thirty to a hundred and fifty; and in the healthy state are seldom larger than an almond. They are most numerous in that part of the mesentery which corresponds with the jejunum. Through these the lacteals may be said to pass in their course to the thoracic duct; they seldom occur nearer to the attached border of the intestine than two inches. Small glands are also disseminated irregularly between the folds of the peritonæum connected with the large intestine; they are not numerous, and require no special consideration.

Lymphatic glands of the abdomen (plate XLVII.)—The lymphatics of the lower half of the body

have been traced into the abdomen, to a series of glands situated in front of the vertebral column and the sacrum. Though these are connected by vessels passing from one to the other, forming a sort of chain in the situation indicated, yet as they are more numerous, or as it were aggregated together at particular points, they are divisible into different series. In the pelvis, some of the glands are placed behind the rectum in the hollow of the sacrum, and are hence named sacral glands; others, situated more externally, surrounding the internal iliac artery, are denominated the internal iliac glands. It does not appear necessary to name them separately; they receive the lymphatics corresponding to the branches of the internal iliac artery, and communicate upwards with the lumbar glands.

The *lumbar lymphatic glands* (plate XLVII. i, i) are very large and numerous; they are placed in front of the lumbar vertebræ, surrounding the aorta and vena cava. To them we have traced the lymphatics which accompany several of the branches of the abdominal aorta, those of the inferior extremity being also connected with them. The vessels passing between the glands here described, progressively increasing in size while their number diminishes, at length form the trunks, which, with those of the lacteals, give rise to the thoracic duct.

The lymphatics of the thorax are divisible into two sets, viz. those of its parietes and those of the contained viscera. The former are arranged in two distinct planes, one lying between the skin and the muscles, the other being deeply seated. The superficial lymphatics at the front of the chest run upon the pectoralis major muscle, for the most part outwards and upwards, to reach the axilla, where they open into the glands. Those on the posterior surface lie upon the trapezius and latissimus dorsi; some incline downwards, others upwards, some transverse,—all converging to the axilla, where, through the medium of the glands, they join with the lymphatics of the upper extremity. The deep vessels at the fore part of the chest correspond, in their general distribution, with the internal mammary artery; for they commence in the muscles of the abdomen, run upwards through the cellular interval, between the fibres of the diaphragm at their attachment to the ensiform cartilage, and so they ascend behind the costal cartilages to the summit of the thorax. In their course they receive branches from the anterior part of the intercostal spaces, and ultimately terminate, that of the left side in the thoracic duct, whilst the corresponding one ends in the right lymphatic trunk.

The lymphatics placed deeply at the sides and back part of the chest (plate XLVII. n, n) follow the distribution of the aortic intercostal arteries; for they receive branches from the dorsal muscles, which come forwards through the inter-transverse spaces, and others from the sides running along the intercostal spaces. All these incline inwards to the spine, and terminate in the thoracic duct.

PLATE XLVIII.

Superficial lymphatics of the upper extremity.

Fig. 1. The anterior view of the arm. The muscles are retained in their relative position by the fascia. The lymphatic vessels take the course of the superficial veins.

No. 1. The convexity of the deltoid muscle. 2. The anterior border of the axilla formed by the pectoralis major muscle. 3. The posterior border of the axilla formed by the latissimus dorsi. 4. The convexity formed by the biceps muscle. 5. The triceps. 6, 7. The convexity of the pronator teres and flexor muscles of the fore-arm.

A, A. The radial vein. B. The anterior ulnar vein. C. The posterior ulnar vein. D. The median vein. E. The median cephalic vein. F. The median basilic vein. G. The basilic vein passing beneath the fascia of the upper arm. H, H. The cephalic vein.

a, a. Lymphatic vessels following the course of the radial and cephalic veins, and crossing the front of the biceps muscle to join the axillary glands, b, b. c, c. A long lymphatic vessel accompanying the cephalic vein. d, d. Ulnar lymphatic vessels proceeding to the axillary glands. e, e. Median lymphatic vessels also ascending to the axillary glands. f, f. Two lymphatic glands immediately above the inner condyle. g. A small gland in the course of the lymphatic vessels of the inner side of the arm. h. A lymphatic gland receiving vessels from the posterior aspect of the upper arm. i, i. Axillary glands receiving lymphatic vessels from the posterior part of the arm and side of the chest.

Fig. 2. A posterior view of the arm, invested by its fascia.

No. 1. The convexity of the deltoid muscle. 2. The triceps. 3. The convex outline of the biceps. 4. The olecranon.

A, A. The radial vein. B, B. The posterior ulnar vein.

a, a. Digital lymphatic vessels. b, b. Lymphatic vessels following the course of the radial vein. c, c. Lymphatic vessels from the back of the fore-arm turning around the arm immediately above the outer condyle to join the axillary glands. d, d. Other lymphatic vessels passing around the inner side of the arm to the axillary glands. e, e. Posterior ulnar lymphatic vessels. f, f. Lymphatic vessels from the region of the deltoid muscle, passing to the axillary glands.

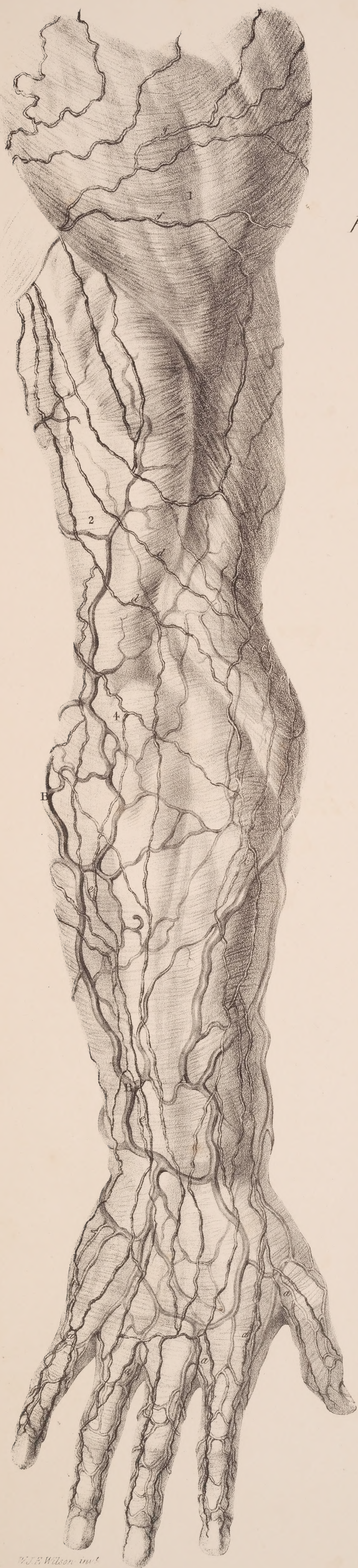
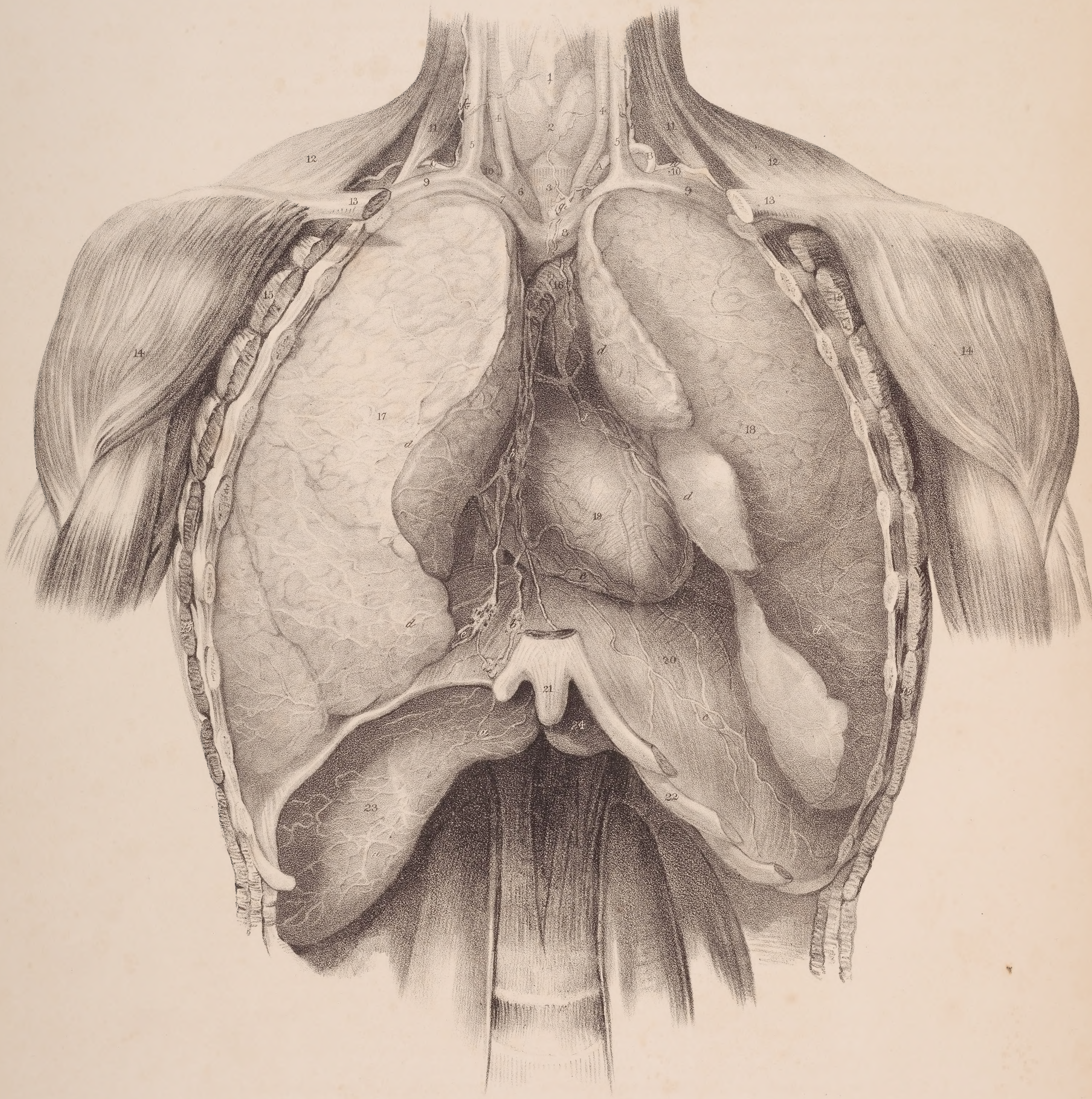


Plate 18.

W. J. F. Wilson invt

Plate 49.



W. J. L. Wilson del.

W. Bagg sculp.

W. Bagg sculp.

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The *lymphatics of the lungs* (plate XLIX. d, d), as in other organs, are disposed in two planes, one being superficial, the other deep-seated. Those at the surface run beneath the pleura, where they form a diffused net-work by their anastomoses. Their number is considerable, but they cannot be demonstrated with equal facility in all cases. "I have been able," says Cruikshank,* "at one time to show the whole external surface of the lungs covered with absorbents I had injected; at another time I have not been able to find one." One of the easiest methods of finding them is to inflate the lungs of a still-born child from the trachea; the air passes from the cells into the absorbents, and enables us to see those on the surface: if a puncture be made into one of them with a lancet, the air will partially escape, and then the injecting pipe, containing a column of quicksilver, can be introduced.† Most of these converge to the root of the lungs, and terminate in the bronchial glands.

The deep lymphatics of the lungs run with the vessels along the bronchi, communicating freely with those at the surface, and at the root the lungs open into the bronchial glands. From these, two or three trunks issue, which ascend along the trachea to the root of the neck, and terminate at the left side in the thoracic duct, at the right in the corresponding lymphatic duct.

Lymphatics of the thymus gland.—On the spinal surface of the thymus, Sir Astley Cooper‡ observes, "numerous absorbent glands are found; and if these be injected, many absorbents are discovered. But upon the posterior surface of the cornua and cervical portion, two large vessels proceed on each cornu, and the side of the trachea, towards the junction of the jugular veins with the superior cava. They are sufficiently large to admit a pipe to throw in coarse injection, and I can readily inject them with wax, dissect and preserve them, so as to make very interesting preparations of them. They pass nearly straight upon the spinal surface of the cornua, converging a little as they proceed towards the sternum, and terminate in the jugular veins by one or more orifices on each side."

Lymphatics of the thyroid gland (plate XLIX).—From each lateral lobe of this organ some absorbing vessels arise, which converge and unite to form one short trunk, that opens at the right side into the right lymphatic duct, at the left into the thoracic. They may be demonstrated by inserting the injecting pipe into the substance of the gland, when the mercury, by its weight, will force its way into the lymphatics.

Lymphatics of the heart (plate XLIX. e, f).—These follow the coronary vessels, from the apex of the organ up to its base. Those of the right side converge to the origin of the aorta; a trunk of some size is thus formed, which runs upwards over the aortic arch, gets between the carotid and brachio-cephalic arteries, where it sinks backwards to the trachea, by which it ascends to the root of the neck, to terminate in the right lymphatic trunk. The left lymphatic branches ascend to the base of the heart; where they also communicate with the preceding, and then proceed, having united into a single vessel, along the pulmonary artery, towards its bifurcation. At this point it gets behind the arch of the aorta, passes through some lymphatic glands, and finally ascends by the trachea to terminate in the thoracic duct.

* Anatomy of the Absorbents, p. 194.

† Loc. cit.

‡ Anatomy of the Thymus Gland, p. 14.

PLATE XLIX.

Lymphatic vessels of the viscera of the thorax, and convex surface of the liver.

No. 1. The thyroid cartilage. 2. Thyroid gland. 3. Trachea. 4, 4. Carotid arteries. 5, 5. Internal jugular veins. 6. Arteria innominata. 7. The right innominata vein. 8. The left innominata vein. 9, 9. Subclavian veins. 10, 10. Subclavian arteries. 11, 11. The anterior scalenus muscle at each side. 12, 12. The trapezius muscle at each side. 13, 13. The clavicles sawn through. 14, 14. The deltoid muscles. 15, 15. The serratus magnus muscle at each side, divided. 16. The arch of the aorta. 17. The right lung. 18. The left lung. 19. The heart. 20. The diaphragm; on the right side a portion is removed to bring into view the upper surface of the liver. 21. The ensiform cartilage. 22. Cartilages of the ribs forming the lower border of the thorax. 23. The convex surface of the right lobe of the liver. 24. The left lobe.

A. The thoracic duct deeply seated at the root of the neck. B. The thoracic duct curving forwards and downwards to terminate at the junction of the left jugular and subclavian veins. C. The right lymphatic duct.

a, a. Lymphatic vessels from the convex surface of the liver, converging to, b, b, a chain of glands and vessels in the anterior mediastinum. c, c. Lymphatic vessels from the diaphragm. d, d. Lymphatic vessels from the surface of the lungs converging towards the roots of those organs. e. Lymphatic vessels of the right ventricle of the heart. f. Lymphatic vessels of the left ventricle of the heart. g. A lymphatic gland receiving converging vessels from the root of the neck and viscera of the thorax. h. A large lymphatic trunk from the upper extremity. i. A lymphatic trunk accompanying the left jugular vein. k. A lymphatic trunk descending along the right jugular vein to terminate in the right lymphatic duct.

Lymphatics of the œsophagus.—Along this tube a plexus is formed by absorbing vessels, which pass upwards upon it, traversing the glands which lie in their course; and after having communicated by anastomoses with the lymphatics of the lungs, at the root of that organ, and also higher up, finally terminate in the thoracic duct.

Lymphatic glands of the thorax (plate XLIX).—In the description of the vessels, we have noticed the ovoid bodies with which they are connected. Thus, six or seven small glands are placed in the course of the internal mammary vessels, and through which the lymphatics pass; they may be named the *anterior mediastinal* glands (b, b). Three or four lie behind the aortic arch, and one before it, (*cardiac glands*,) having a similar relation to the lymphatic vessels; some, also, are found along the œsophagus, varying from fifteen to twenty in number (*œsophageal glands*). At the root of the lungs ten or twelve similar bodies are placed of larger size, and usually named *bronchial glands*. The largest of these occupy the interval between the bronchi at their bifurcation, whilst others of smaller size rest upon these tubes for some way within the lungs. In early infancy their colour is pale red; towards puberty, we find them verging to gray, and studded with dark spots; at a more advanced age they are frequently very dark. In chronic diseases of the lungs they become enlarged and indurated, so as to press on the air-tubes, and cause much irritation. They are frequently the seat of tubercular deposits.

Lymphatics of the superior extremity (plate XLVIII).—These are divisible into two series, one of which is superficial, the other deeply-seated; the former accompanying the cutaneous veins, the latter following the course of the deep vessels.

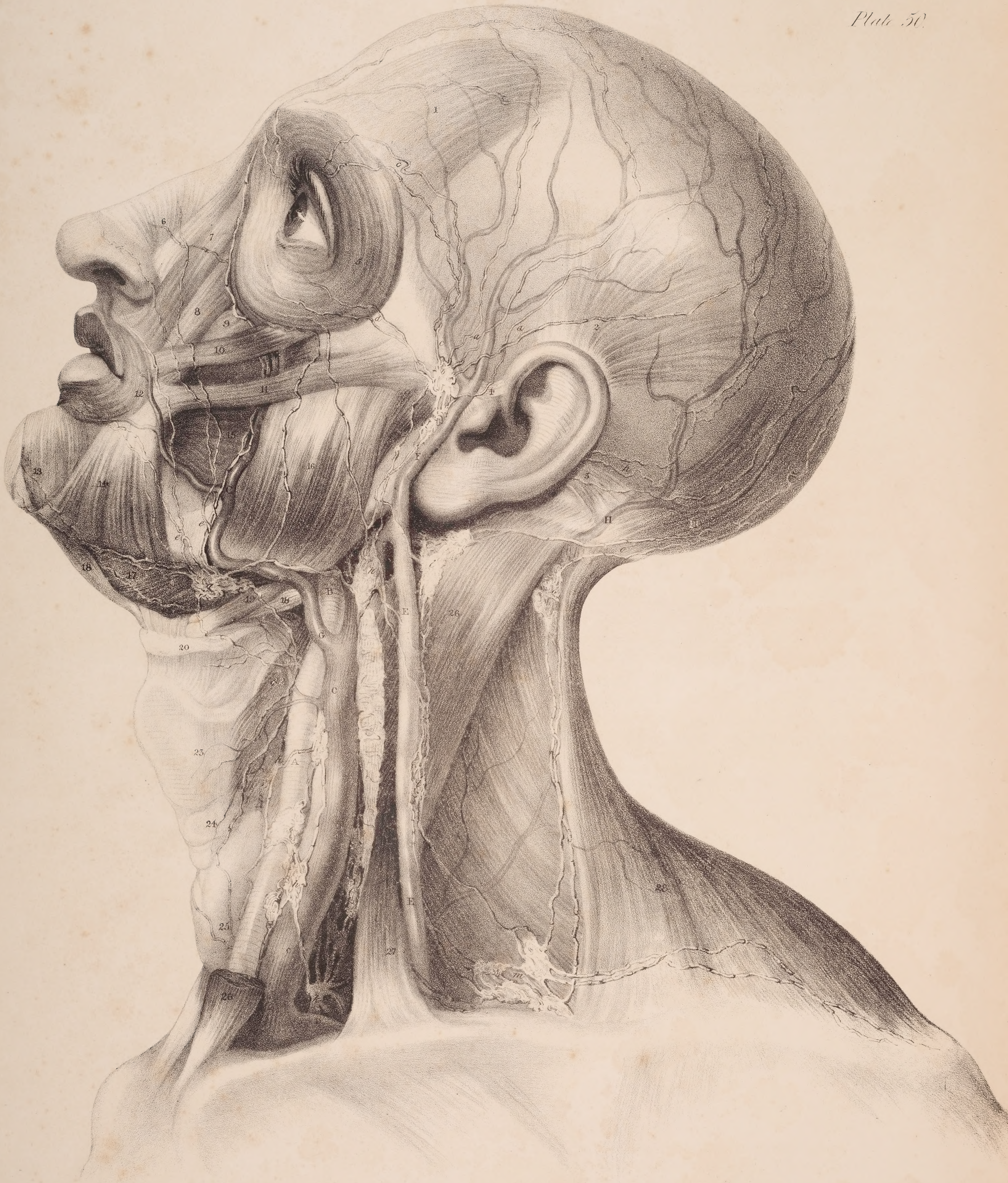
The *superficial lymphatics* commence by two divisions. Of these, one corresponds with the branches of the ulnar cutaneous vein, which its different ramusculi accompany, from the inner border of the hand, along the anterior and inner surface of the fore-arm as far as the bend of the elbow. In this course they receive numerous branches from the surrounding parts, and join at the point just indicated with a portion of those which constitute the second or external division. Some now enter a lymphatic gland (f) situated in front of the inner condyle of the humerus; continuing their course upwards from thence, they terminate either in glands placed along the brachial artery, or in those of the axilla, where they unite with the deep lymphatics. Those which constitute the second division are less numerous than the preceding. Proceeding from the integuments on the outer margin and back of the hand, they follow the course of the radial cutaneous veins to the bend of the elbow; here the greater number become united to the preceding series, whilst a few accompany the cephalic vein, ascend on the external side of the arm, pass with that vessel between the deltoid and great pectoral muscle, and end in one or more lymphatic glands beneath the clavicle, communicating with those at the lower part of the neck.

The deep lymphatic vessels correspond exactly to the arteries which they accompany. In the fore-arm, the deep lymphatics consist, therefore, of three sets, associated with the radial, the ulnar, and inter-osseous arteries; in their progress upwards they maintain communication with those placed superficially. Some of them pass to the glands which lie near the brachial artery; finally, all end in the glands of the axilla.

The *glands of the axilla* (plate XLVII. v; plate XLVIII. b, b, i, i) are generally ten or twelve in number; in this, however, as well as in their size, they vary considerably in different individuals; they are placed along the axillary vessels, embedded in a quantity of loose cellular tissue. They receive the lymphatic vessels of the arm already described, as well as those proceeding from the integuments of the back, from the anterior surface of the thorax and mamma, and are therefore liable to be influenced by disease affecting any of these parts.

From the glands in the axilla, vessels, fewer in number but larger in size, issue and proceed along with the subclavian artery, in some parts twining round it. From the top of the thorax they ascend into the neck, close to the subclavian vein, and terminate, those of the left side in the thoracic duct, those of the right side in the second or smaller lymphatic duct. These vessels sometimes unite into a single trunk, which opens separately into the subclavian vein near its termination.

Lymphatic vessels and glands of the head and neck (plate L).—The lymphatics of the head consist of those of the cranium and the face. The former commence by a series of minute radicles disseminated over the scalp; in their descent they diminish in number, increasing in size, and separate into an anterior and posterior division, which follow respectively the course of the temporal and the occipital arteries. The former pass in front of the ear; some at this point enter one or two glands usually placed in the immediate neighbourhood of the zygoma, while others go to those situated on the parotid gland; finally all end in the lymphatic glands of the neck. The posterior division of the cranial



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lymphatics accompany the occipital artery, then pass to the glands situated behind the ear (over the mastoid process of the temporal bone), and thence join the superficial lymphatics of the neck. The superficial lymphatics of the face, more numerous than those of the cranium, descend obliquely in the course of the facial vein, and join the glands placed beneath the base of the lower maxillary bone; a few of these in their descent pass through one or two glands situated over the buccinator muscle. The deep-seated lymphatics of the face issue from the cavity of the nose, the mouth, &c., and proceed in the course of the internal maxillary artery; when arrived at the angle of the jaw, they join the glands which occur at this point. The lymphatic glands described as existing on different parts of the head are few and very small; those of the neck, on the contrary, are comparatively large and very numerous.

The *cervical glands* (plate L.) are almost all placed on the sides of the neck, and are divisible into a superficial and deep-seated series. Of the former, some lie along the base of the inferior maxillary bone (g); the remainder, disposed in the course of the external jugular vein, (l, l) occur in greatest number in the angular space behind the lower end of the sterno-mastoid muscle, where the external jugular joins the subclavian vein; at the point indicated, they approach and communicate with the axillary glands. The deep-seated cervical glands (h, h) are placed along the carotid artery and internal jugular vein, extending downwards on different sides of these vessels as far as the thorax. The lymphatic vessels of the cranium and face (already described), together with those of the pharynx, larynx, and other parts of the neck, being received into these glands, and again issuing from them, progressively diminish in number during their descent, and ultimately, at the bottom of the neck, unite into one trunk. This vessel usually pours its contents at the left side into the thoracic duct (k), immediately before its termination, and at the opposite side into the large right lymphatic duct (plate XLVII. D); it, however, sometimes terminates separately at the confluence of the subclavian and internal jugular veins, or in one of these vessels immediately beyond their point of junction.

Right lymphatic duct (ductus lymphaticus dexter; plate XLVII. D; plate XLIX. C).—This is a short vessel, about two lines in diameter, and about three quarters of an inch in length, which receives the lymph from the absorbents of the right upper extremity, and corresponding side of the head and chest. It runs obliquely into the angle formed by the union of the right subclavian and internal jugular veins, where its orifice is guarded by two valves.

PLATE L.

Lymphatic vessels and glands of the head and neck.

- Nos. 1, 1. The occipito-frontalis muscle. 2. The attollens aurem muscle. 3. The retrahens aurem muscle. 4. The attrahens aurem muscle. 5. The orbicularis palpebrarum muscle. 6. The compressor narium. 7. The levator labii superioris alæque nasi. 8. The levator labii superioris proprius muscle. 9. The levator anguli oris. 10. The zygomaticus minor muscle. 11. The zygomaticus major. 12. The orbicularis oris. 13. The depressor labii inferioris muscle. 14. The depressor anguli oris. 15. The buccinator muscle. 16. The masseter muscle. 17. The mylo-hyoideus muscle. 18. The digastricus muscle. 19. The stylo-hyoideus muscle. 20. The hyoid bone. 21. Part of the middle constrictor muscle of the pharynx. 22. The origin of the inferior constrictor muscle. 23. The thyroid cartilage. 24. The cricoid cartilage. 25. The thyroid gland. 26, 26. The sterno-mastoid muscle; its middle portion is removed to bring into view the deep cervical vessels with their accompanying lymphatics. 27. Part of the clavicular origin of the sterno-mastoid. 28. The trapezius muscle.
- A. The common carotid artery. B. The external carotid. C, C. The internal jugular vein. D. The subclavian vein. E, E. The external jugular vein. F. The temporal vein. G, G. The facial vein. H. The occipital vein.
- a. a. Temporal lymphatic vessels converging to b, b, lymphatic glands situated near the zygoma and parotid gland. c, c. Two lymphatic vessels from the eyebrow and integument of the forehead, passing backwards to the zygomatic glands. d. Lymphatic vessels from the lower eyelid converging to the same glands. e, e. Lymphatic vessels from the forehead, nose, and mouth, following the course of the facial vein, to the submaxillary lymphatic glands. f, f. Submaxillary lymphatic vessels also converging to the submaxillary lymphatic glands, g. h, h. Deep cervical lymphatic glands and vessels, receiving lymphatic branches from the anterior part of the neck and thyroid gland. i, i. Lymphatic trunks converging from the neck and upper extremity to the termination of the thoracic duct, k. l, l. Superficial cervical glands and vessels accompanying the external jugular vein, and terminating in a group of glands, m, which receives the lymphatic vessels from the posterior part of the neck and superficial parts of the shoulder, and communicates with the axillary glands. n. Occipital lymphatic vessels terminating in glands situated behind the ear. o. Other lymphatic vessels communicating with the superficial cervical vessels and glands.

END OF THE VASCULAR SYSTEM.

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